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PRESERVING
THE RESIDENTIAL CHARACTER
OF
HAMILTON BEACH

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REPORT OF THE HAMILTON BEACH COMMUNITY
DEVELOPMENT PROJECT

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INTRODUCTION

Hamilton Beach, a neighbourhood community with a 1980 population of 1,512 (see Figure 1), is in danger of losing its residential character. While the City of Hamilton and the Hamilton Conservation Authority have initiated a Land Acquisition Programme and are purchasing Beach properties to facilitate future regional parkland development, the Ontario Ministry of Transportation and Communications (MTC) is purchasing and removing Beach properties to facilitate local highway improvement. At the present time, the City of Hamilton and the Region Conservation Authority have purchased and removed 143 residences while the MTC has purchased and removed 135 residences. Over the next 20 to 30 years the Land Acquisition Programme will continue and every remaining residence, business and social gathering place will be purchased and removed to make room for what amounts to an unplanned regional park. In short, the very existence of the Hamilton Beach Neighbourhood is being threatened.

In order to lend support to their parkland scheme for Hamilton Beach, City and Regional officials have concluded that the Beach Neighbourhood is unsuitable for permanent residential use. According to these officials, the reasons are: air and noise pollution levels; serious health hazards caused by fluctuating water levels which result in flooding and the backup of septic tanks; the technological and economic infeasibility of installing sanitary sewers on Hamilton Beach; the poor quality of homes and neighbourhood services; and the suitability of Hamilton Beach for beach activities, boating, fishing and for viewing steel

plants and harbour activities.¹

As impressive as these arguments may seem on the surface, it must be remembered that they were formulated in the early 1970's and may or may not reflect current conditions on Hamilton Beach in the 1980's. Consequently, the purpose of this study is to investigate the neighbourhood concerns expressed by Regional officials and to determine the present and future suitability of Hamilton Beach for permanent residential use.

The first chapter of this study analyzes past and present levels of air and noise pollution on Hamilton Beach, investigates their source and the effects on the health of Beach residents and area properties, discusses the ways in which pollution levels can be further reduced and asks the question: Is Hamilton Beach that much worse than other residential areas in the City of Hamilton and other cities across North America?

The second chapter of this study looks at the flood potential on Hamilton Beach. By analyzing the long-term probability of ground and surface water flooding in the area and its effects on both the structural soundness of residences and private sewage systems, it is possible to determine whether or not flooding constitutes a legitimate justification for the public acquisition of Hamilton Beach.

Following up on the various private sewage system alternatives presented in Chapter 2, the third chapter of this study then describes and analyzes the public sewerage alternatives available to the Beach neighbourhood.

The fourth chapter of this study begins by setting out both the positive and negative characteristics of the residential

neighbourhood and looks at its suitability for residential use. Following this initial section of the chapter, an analysis is made of the need for additional regional parkland in Hamilton-Wentworth Region and the suitability of Hamilton Beach for regional parkland purposes. The last section of this chapter looks at the precedence for mixed residential/recreational land use schemes and determines the suitability of Hamilton Beach for mixed land use.

Finally, the last section of this study pulls together arguments for maintaining the residential character of Hamilton Beach and offers preliminary recommendations for the achievement of this goal.

AIR AND NOISE POLLUTION ON HAMILTON BEACH

According to government officials, air and noise pollution levels on Hamilton Beach make it unsuitable for permanent residential use. It is readily apparent that industrial emissions are blown across Hamilton Beach by prevailing westerly winds and that the Queen Elizabeth Way being immediately adjacent to the residences, exposes the area to high noise levels and further pollution from vehicular emissions. At a glance the argument seems warranted. But what are the actual values? What are these pollutants and do their levels exceed the objectives prescribed by the Ministry of the Environment? Is Hamilton Beach that much worse than other residential areas in the city?

Air pollution in Hamilton is of major concern because of the industrial character of the city. The steel manufacturers and the wide variety of related industries are major sources of air and noise pollution. The Ontario Ministry of the Environment prepared an emissions inventory in the late 1960's and set up objectives for various pollutants monitored in Hamilton. Since then there has been much improvement in air quality.² The major problem still remains the high level of particulates throughout the city. Similarly a noise survey conducted in 1972 revealed that many areas in the city experience noise levels equivalent to those recorded on Hamilton Beach. It therefore seems unfair to use the present argument as a distinguishing feature of Hamilton Beach when the same can be said about many other neighbourhoods. The analysis of air and noise pollution includes the following sections. Why is air pollution a major

concern in Hamilton? Here a combination of various conditions influencing air quality are described. How are major industries dealing with air pollution? A brief description of pollution control measures taken by Stelco and Dofasco is presented. The next section contains the data collected by the Ministry of the Environment, Air Resources Branch, West Central Region, on the pollutants monitored throughout the city.

The strike situation at Stelco in 1981 offered the opportunity to investigate air quality when a major source of pollution was shut down and a summary of the Ministry of the Environment report on air quality during that period is presented.

Given the data on air quality, a comparison between Hamilton Beach and other areas in Hamilton is then made.

The next sections deal with general aspects of air pollution. What effects does air pollution have on human health? Detailed information on health effects are described in Appendix C while a general overview and other variables that influence the impact of air pollution on human health are dealt with in this section.

What are the potential hazards of poor air quality? Donora, a small town in Pennsylvania, serves as an example. In 1948, smog caused by poor atmospheric conditions plagued this town and a brief account of this situation is described. This example is used to demonstrate that air quality is greatly affected by meteorological factors and poor air quality has widespread effects.

A discussion on odor and its role in pollution follows. Does air pollution have an effect on buildings, cars and other materials? Yes; just look at an old brick building.

To what extent does air pollution damage inert material? The effects of various pollutants on different materials is examined in this section.

Having dealt with air pollution, the focus then turns to noise pollution. The first section examines the following questions: what are the impacts of excessive noise levels on people? How are high noise levels and human responses related?

Noise in residential areas can be attenuated in a number of ways. These measures are described in terms of their cost, effectiveness, and changes in attitude toward noise as a result of their implementation.

Since road traffic is the major source of noise on Hamilton Beach, a brief discussion on this particular type of noise precedes the section detailing noise levels on Hamilton Beach. Noise levels measured are compared to those measured throughout the city of Hamilton.

Conclusions based on this research point to the fact that Hamilton Beach is exposed to levels of air and noise pollution found in other neighbourhoods in Hamilton. Therefore the argument that Hamilton Beach is not suitable for permanent residential use because of adverse conditions of air and noise pollution cannot be used to justify the acquisition program.

Why Air Pollution is of Major Concern in Hamilton

Industrial Sector

Hamilton is known as the "steel city" mainly because of its many steel related industries. A great proportion of the city's

working population works in industries related to the production and use of steel. Most of the industries and others are located in an area North East of the downtown core, with direct access to the harbour (see Figure 1). This industrial sector creates one of the two pollution cells in Hamilton, the other one being centred on the downtown business core.³

Sources of air pollution are found in the many stages of steel making, most of which can be controlled to some extent. For example the iron ore and coal destined for the blast furnaces and coke ovens are brought in by ship, unloaded and stored on the docks. Stelco's 2.2 million metric tons of iron ore and 1 million metric ton of coal are stored on the docks during the winter months and are indeed a source of pollution. Usually water is sprayed on the coal piles but during freezing weather, the coal piles are levelled off and covered with a centimeter of asphaltic material and are also sprayed with oil.⁴

Most of the roads on industrial properties are not paved and contribute greatly to the level of airborne dust and particulates. Spraying oil on these roads only temporarily controls the dust and not all industries are actively involved in such activity.⁵

These are but two of the many sources of pollution emitted by industry. Apart from industrial emitters, other traditional sources such as transportation, fuel combustion, solid waste disposal and individual space heating add to the complete picture.

Total emissions in a city don't change radically. What determines the ambient or surrounding air quality is the

combination of various physical factors of the area and the meteorological effects of wind direction and speed, turbulence, temperature, and stability.⁶ These factors combined, determine the extent of dispersion and dilution of air pollutants. The combination of physical features and meteorology is critical in Hamilton mainly because of its topography, urban morphology and its proximity to Lake Ontario.⁷

Physical Features

Topography: The striking feature in Hamilton is the Niagara Escarpment which tends to hamper normal air ventilation and movement. The effect of features such as valleys cause winds to persist in certain directions more often than others and in this way the Dundas valley, created by the escarpment, funnels westerly and south westerly winds across the lower city and the industrial sector out over lake Ontario about 62% of the time.⁸

Urban Morphology: As previously stated, Hamilton exhibits two major pollution cells. One is situated in the industrial sector and the other is situated in the downtown business district.

Proximity to lake Ontario: Although winds from an eastern direction blow only about 20% of the time, the result is quite drastic.⁹ Easterly winds are cooled over the lake and when they reach Hamilton, they trap the pollution through a process called low-level inversion and atmospheric stability. The air pollution index increases sharply during an inversion and industries are notified so that proper action can be taken.

Meteorology

Wind Direction and Speed: Wind direction in Hamilton is of great importance because of the location of the industrial sector near the lakeshore. Westerly winds blow across the city and disperse pollutants over Hamilton Beach and Lake Ontario. In a study by Rouse and McCutcheon, regional winds in Hamilton proved to be most significant in influencing the concentration of pollutants in different parts of the city.

While west and south westerly winds tend to have a cleansing effect on the city, cooler winds from an easterly direction produce a low level inversion and atmospheric stability thus trapping pollution. When winds change from the east to the west, new pollution patterns are formed within six hours.¹⁰

The amount of pollution downwind from a source depends on the wind speed; the higher the wind speed, the greater the dilution effect, and the lesser the concentration of pollutants. But this dilution effect does not hold true for hot emissions from high stack sources. The increased wind speed affects the plume rise by lowering it and the result is an increase in concentration of pollutants at ground level. A critical wind speed exists for each stack design for maximum concentrations downwind.¹¹

Turbulence: Turbulence also affects diffusion of pollutants. Their random motion disperses pollutants about a mean wind path.

Temperature and Stability: During normal conditions, air closer to the surface of the earth heats up faster than air in higher areas and rises, thus dispersing the pollutants. But during an inversion, the temperature of a layer of air increases with height, air closer to the surface cannot rise, pollutants

are not dispersed and their concentrations increase sharply.

There are basically three types of inversions: radiation inversions, advection inversions and subsidence inversions. (see Appendix A)

Air stability refers to the decrease in temperature with height. When the temperature drops one degree Celcius per 100 meters, a neutral condition is said to exist. Unstable air results when the temperature decreases at a greater rate. Light winds and heat from the sun contribute to the instability. Smoke plumes behave differently under different stability conditions (see Figure 2).

The interaction between emissions, topography, morphology and meteorology create a unique situation with regards to air pollution in Hamilton. Ambient air quality is a combination of all these factors. It is therefore easy to understand that there will be days when the combination of meteorological conditions and upsets in the processes in conjunction with some other factors will result in less than satisfactory conditions throughout the city.

Pollution Control Measures by Stelco and Dofasco

Pollution control measures existed before the formation of groups concerned with environmental protection. In 1928 Stelco installed mechanisms for collecting, cleansing and recycling blast furnace gas.¹² After the formation of the Ontario Ministry of the Environment in the late 1960's, both government and industry collaborated in studying and cataloguing pollutants. The resulting emission inventories served to identify sources of emissions and led to programmes aimed at controlling and reducing these

emissions. In 1970 the inventory revealed that industry in Hamilton was responsible for more the 90% of emissions of particulate matter.¹³ Although other sources such as automobile exhaust, ships and aircraft, heating equipment in various buildings also existed, industry contributed most to the total particulate level.

Based on regulations derived from the Environmental Protection Act, a cooperative emission control programme was set up between the Ministry of the Environment and Hamilton's industries; it had its greatest effects on Stelco and Dofasco. Industries had been involved in some type of emissions control previous to this but it was the Government's initial step in that direction.¹⁴

Air Pollution Control at Stelco¹⁵

Stelco is Canada's largest steelmaker. It produces nearly six million tons of steel a year. Since 1960 Stelco spent \$130 million on environmental control measures. At Hilton Works alone, \$53 million were spent on air quality control equipment. Stelco reports that it now captures 98% of the dust emitted through processes at Hilton Works.

Dusting from coal while it is being unloaded and stored in stockpiles is controlled by spraying it with water in the warmer months and with oil in the winter. Further studies into the dusting problem has led Stelco to implement other measures. These are: re-orientation of coal piles; shaping of coal piles to reduce turbulence; installing high porous fences to reduce turbulence; installing a snow fence at the leeward edge of the

pile; the application of an asphaltic product on the piles at the end of the shipping season.

Particulate emissions at Stelco have been reduced by over 75% over a 10 year period.(see Figure 3) Various measures have been implemented over the years to control emissions during the many stages of steelmaking. Some of these controls include: Installing new charging cars on all batteries during the coking process; installing a ventilated shed over two batteries (coking process); installation of a spary suppression system (coking process); cleaning gas emitted from blast furnace in three ways:

- dust catcher,
- venturi scrubber,
- precipitator;

installation of a wet scrubber (sinter plant); installation of a baghouse to clean air from area where molten iron is transferred; installation of electrostatic precipitators in Open Hearth and Basic Oxygen Furnace shops.

Stelco has undertaken over 120 environmental projects at Hilton Works alone. More than 98% of dust emitted through various processes is captured by control measures.

Air Pollution Control at Dofasco¹⁶

Dofasco is Canada's second largest steelmaker. In 1979 it produced over 4 million ingot tons of steel. Dofasco implemented its first pollution control programmes in the late 1960's. Since then they have been able to reduce their total emissions by two thirds. Environmental control during the years 1970-1979 cost Dofasco a total of \$110 million.

Storage of iron ore, limestone and dolomite does not produce

dust whereas coal being fine, can be picked up by winds and carried long distances. To control this, coal piles are sprayed with water or with oil. They are also shaped so as to reduce turbulence and subsequent dusting. Another source of particulate emission arises from the transfer of these materials to conveyor belts or transfer cars and here the control measure consist of shrouding the area and cleaning the exhausted gas.

Unpaved roads and open areas such as parking lots are oiled and the company plans on attaining a further reduction in dusting by paving and increasing the cleaning frequency of roads. They are also investigating winter time cleaning equipment to better suit their needs. Dofasco also plans to further landscape and grass more areas.

Figure 4 shows that Dofasco has achieved a 75% reduction in emissions from the above mentioned sources. Further sources of particulate emissions stem from the various stages in the process of steel making. Unlike emissions from storage piles, road and yard dust that settles usually close to the plant, these emissions are usually finer and are discharged above ground level after which they can be transported far before settling.

Potential emissions of particulates are captured through the many stages of coking, quenching, blast furnace casting and steelmaking. Figure 5 shows how much each individual process contributes to particulate emissions and the projected reduction by 1985.

Control measures enable Dofasco to capture 98% of sulphur dioxide emissions which is well within the requirements of the Ministry of the Environment. Dofasco reports to have completed

the work required in order to comply with regulations by the Ministry of the Environment. The company feels that over the next few years they will be able to further reduce particulate emissions and will fully operate within the Ministry's standards.

The implementation of various emission control measures by industries have undoubtedly led to the overall improvement in Hamilton's air quality. Adapting new technology to old machinery has been a problem but what is of major concern is the fact that industries have reached the point of diminishing returns in terms of environmental benefits per dollar expended.

Air Pollution in Hamilton Over the Last Ten Years

Monitoring Air Pollution

The objective of the Air Management Programme in Ontario is based on the control of man-made emissions so as to conform with set objectives that are based on known effects on health, vegetation and quality of life. Air monitors are used to measure levels of pollutants in our surrounding atmosphere, so called ambient air. Monitors are usually installed in areas that are suspected to experience high levels of pollution. When the measured levels are below or reach the set objectives it is then safe to say that other areas experience similar or better air quality.

The Ministry of the Environment (MOE), Air Resources Branch, West Central Region, has set up quite an extensive network of ambient air quality monitors throughout Hamilton. (see Figures 6a and 6b) There are two major stations which analyze most pol-

lutants; all other stations only measure from one to three pollutants. The Barton/Sanford station (no. 29025) is the most important station since it provides data which is used to calculate the Air Pollution Index (see below). The other major station is North Park (no. 29008) which is situated on Hamilton Beach on North Park Ave., immediately adjacent to the Queen Elizabeth Way.

The MOE tabulates the data collected from all monitors and publishes a yearly report on air quality in Hamilton. Data from the 1979 Hamilton Air Quality and 1980 Hamilton Air Quality reports is presented here.^{17, 18} Although the 1981 report has not yet been published, the data was obtained directly from the Ministry and is included in this section. A detailed discussion on the major pollutants is presented in Appendix B.

Air Pollution Index

The warning system used to identify times when air quality becomes very poor is called the Air Pollution Index (API). It is based on the levels of sulphur dioxide and particulates measured at the Barton/Sanford station. The combination of these two compounds seemed to be the best indicator of harmful health effects. When the API reading exceeds 31, major emitters are requested to curtail some of their operations; when the API exceeds 49, there is a mandatory cutback by major emitters and other smaller industries.

In 1979 there were 22 instances when the API reached or exceeded 32 and this was mainly due to the great number of atmospheric inversions. A fewer number of inversions in 1980

resulted in only five instances of API reaching or exceeding 32. In 1981 there were eight such instances. (see Table 1)

Particulates

The MOE uses three different ways of measuring the level of particulates. Each method corresponds to a specific range of size of particles collected:

- High Volume Sampler: it measures particles ranging from sub-micron to 50 microns in diameter. It is usually referred to as Total Suspended Particulates (TSP).
- Coefficient of Haze Tape: it measures fine material approximately 10 microns in diameter. It is usually referred to as the Soiling Index.
- Dustfall Jar: these jars collect particles that are about ten microns or more in diameter. Measurements are usually taken every 30 days.

The basis for objectives for particulates measure by coefficient of haze tape (COH) and high volume sample (Hi-Vol. data) when in combination with sulphur dioxide, is health effects. As for the API, this combination seems to be indicative of health effects but this does not necessarily imply a cause and effect relationship. The objective for dustfall is based on nuisance effects, i.e. the level at which dustfall becomes a nuisance to people.

Results for TSP indicate that the objective seems to be exceeded at monitors situated close to the industrial sector and one other small area of light industry near Main Street and the 403 highway. Higher values for suspended particulates are recorded in areas of higher urban activity, mainly road traffic. (see Tables 2 and 3)

The Barton/Sanford and North Park stations monitor soiling

index on an hourly basis. Over the last three years the readings at the Barton station have fluctuated but still remain slightly above the yearly objective. The North Park station on the other hand has constantly remained high above the yearly objective. It is reported that this may be due to the fact that winds are most commonly from the southwest and also because the station is immediately adjacent to the Queen Elizabeth Way. Six other stations monitor the soiling index but their instrumentation functions only every two hours and yields data that is 25% lower than the one hour telemetered instruments. Therefore caution is advised when comparing results from one hour and two hour telemetered instruments. (see Table 4)

Dustfall has remained relatively stable during the 1970's. portion of the lower city and Hamilton Beach suffer from very high levels. In 1980 these areas averaged twice the MOE's objective. In 1981 similar values were recorded. Only two stations had yearly averages lower than the objective in 1981.

This remains a puzzling situation given that industrial process emissions have been greatly reduced and as shown in Figure 7, there have been large reductions in soiling index and TSP concentrations. Dustfall increases with proximity to the industrial area and the central business district. (see Table 5)

Sulphur Dioxide

The industries are the major emitters of sulphur dioxide in Hamilton. Fuel combustion by homes and other buildings contribute only a small proportion. Only the two major stations constantly monitor sulphur dioxide and objectives are based on vegetation

damage, a more stringent objective than health effects. The concentrations of sulphur dioxide have remained below the hourly objective during the last few years.(see Table 6)

Total Reduced Sulphur

Monitoring of total reduced sulphur is done continuously at the North Park and the Barton/Sanford stations. The objective is that for hydrogen sulphide and is based on an odour threshold level. Sources of hydrogen sulphide and related sulphur compounds in Hamilton are mainly the steel companies' coke ovens, certain slag reclamation processes, and at times a manufacturer of carbon black. Other minor sources are the sewage treatment plant and the Windermere basin. Data tends to point towards an upward trend in the concentration of total reduced sulphur. The MOE suggests that this may be partly due to meteorological factors but the cause has yet to be totally determined. Data for total reduced sulphur is presented in Table 7.

Carbon Monoxide

Carbon monoxide is monitored at the Barton/Sanford station and although the 1981 average was higher, there appears to be a downward trend over the last ten years. This is mainly due to automotive emission controls. Concentrations are below the objectives based on health effects.(see Table 8)

Oxides of Nitrogen (NOx)

In Hamilton high temperature combustion sources are the primary contributors of oxides of nitrogen. Both the North Park

and Barton/Sanford stations provide data for nitrogen oxide (NO), nitrogen dioxide (NO₂), and nitrogen oxides (NO_x). Odour threshold levels and health effects provide the basis for objectives for nitrogen dioxide only.

Yearly trends for oxides of nitrogen have shown a decreasing trend. The level for nitric oxide at the North Park station for 1981 and 1980 is about three times that recorded at the Barton/Sanford station. The explanation stems from the fact that the North Park station is immediately adjacent to the Queen Elizabeth Way which offers a prime source of nitrogen oxide which is later oxidized to nitrogen dioxide in the atmosphere. Data for oxides of nitrogen is presented in Tables 9, 10 and 11.

Ozone

Industrial and automotive emissions provide the pollutants required for photochemical reactions which produce ozone; oxides of nitrogen and hydrocarbons react with sunlight in this process. Once again vegetation and health effects are used to determine the objective; for ozone the hourly objective is .08 parts per million (ppm).

There was an increase in 1980 but the yearly average declined in 1981 to .0163 ppm. The MOE points out that concentrations of ozone in Hamilton are among the lowest recorded in Southern Ontario. The explanation for this is the fact that the high temperature combustion sources produce high levels of nitric oxide which is a scavenger of ozone. The problem with ozone and other oxidants is that they can be transported for long distances and their formation is quite complex. Levels of ozone in Hamilton

can be affected by industrial emissions quite a distance away. Data for ozone is presented in Table 12.

Fluoridation

The major sources of fluoride in Hamilton are the basic oxygen furnaces. There are two objectives for fluoride one being more stringent than the other since it is based on vegetation damage. During the growing season, roughly April 15th to October 15th, the objective is 40 micrograms per 100 square centimeters per 30 days (ug/100sq cm/30 days), but during the remainder of the year it is 80.

The concentrations of fluoride decreased greatly during the period of 1970-1974 and have remained stable since. Again the trend seems to be that the closer the monitoring station is to the source, the higher the level of fluoridation. Data for fluoridation is presented in Table 13.

Dustfall: A Complex Problem

As pointed out earlier, most of Hamilton suffers from a high level of dustfall. All areas of the city except for the north end or the Burlington side of the Beach (OPP building) and one station on the mountain had readings above the MOE's objective. In the industrial sector readings were at least five times the objective.

Most other pollutants showed a decline throughout the early 1970's because of controls on point source emissions but dustfall seemed to be unaffected by pollution control measures. (see Figure 7) This points to the fact that dustfall must be coming from

'fugitive sources'. It somehow evades pollution control devices. These fugitive sources can be uncontrolled stock piles, excavation and construction, road dust, open lots susceptible to wind erosion, etc.

The MOE Air Resources Branch decided to study this problem since it appears that "there is a limit to further air quality improvements which could be undertaken" and they are "becoming increasingly costly and decreasingly efficient."¹⁹ In 1979 the Ontario Research Foundation began a study investigating this problem in collaboration with the Concord Scientific Corporation, United Technology and Science Inc., and the MEP Company. Their report entitled "An Assessment of Street Dust and Other Sources of Airborne Particulate Matter in Hamilton, Ontario"²⁰ was presented in November of 1981 and basically the results of this study indicated that:

1. The largest contributor to the total suspended particulate levels during the period of study was road dust and other traffic related sources. The contribution was 40% (25% due to road dust; 15% due to vehicular emissions).
2. The next largest contributor was background levels of particles transported over long distances into the area. The contribution here was 35%. These background particles basically consist of ammonium sulphate, nitrates and organic material.
3. Area sources contributed 18% and point sources (predominantly steel manufacturing related) only contributed about 7% to the total level of suspended particulates.

In their analysis of street cleaning methods, these researchers found that "more frequent sweeping of roads and streets is unlikely to be a cost-effective approach to achieving significant reductions in urban total suspended particulate levels".²¹

Hamilton Air Quality During Stelco Strike

From August to December 1981, operations at Stelco's Hilton Works were shutdown because steelworkers were on strike. This offered the opportunity for the MOE to determine Stelco's contribution to the quality of ambient air since the emissions from most industries in that sector are quite similar. They studied pollutants related to the steelmaking process and excluded those unrelated to Stelco emissions like ozone and those such as carbon monoxide which occur in very low concentrations. The data presented here was extracted from the MOE report.²²

Most data was obtained from the North Park and the Barton/Sanford stations on the following pollutants: particulates (soiling index and total suspended particulates); iron content in suspended particulates; sulphur; nitrogen dioxide.

Fluoridation was also noted although no correction for weather could be applied since it is measured monthly.

Results indicated that the level of dustfall was not significantly altered except in areas in close proximity to the industry. Levels near this sector were 20% lower. Fluoridation showed similar results. Levels did not change at locations in the lower city at some distance from Stelco however fluoridation levels near the industry demonstrated a reduction of 65% to 75%.

The levels of sulphur dioxide and nitrogen dioxide decreased but not in appreciable amounts. The SPI during this period exceeded the advisory level of 32 on two occasions. On both these occasions the precipitating factor was the adverse meteorological conditions. This stresses the point that ambient air

quality can be significantly altered by conditions other than the level of pollution emitted.

Overall gaseous pollutant levels were not significantly affected by the strike. The percentage decrease from levels recorded in the previous year was significant especially at the North Park station. When converted to actual figures these percentages represent very small amounts since the levels were low initially.

Comparison: Hamilton Beach vs. Other Neighbourhoods

The unique feature of Hamilton Beach which differentiates it from other neighbourhoods with regards to air pollution, is that it is downwind from the industrial sector. During periods of inversions or poor ventilation the whole city suffers from poorer ambient air quality. Winds do not always blow from the west or southwest so Hamilton Beach is not constantly affected by poorer ambient air quality.

Some pollutants can be transported over long distances, others are dispersed and diluted fairly quickly, and their characteristics may be altered under different meteorological conditions. The dispersion of pollutants from vents and stacks is quite a complex state of affairs; it depends on the physical and chemical nature of the effluents, the meteorological situation, and the nature of the area downwind from the stack. Caution must be taken in interpreting data from the monitoring stations since they can only be representative of the immediate surrounding area; more specifically, the readings at the North

Park station can be distorted because of its location immediately adjacent to the Queen Elizabeth Way. Readings of nitrogen oxides are distorted in this way.

Hamilton Beach is also an unsheltered area compared to most neighbourhoods in the lower city especially those embedded within the outskirts of the industrial sector. Winds may disperse pollutants over Hamilton Beach at a greater rate than in neighbourhoods sheltered by large buildings or warehouses in the industrial sector. So does Hamilton Beach suffer from a serious air pollution problem? Is it so much worse down there compared to other neighbourhoods in Hamilton? Taking the above factors into consideration here is a general comparison of levels of certain pollutants in various areas of the city.

The data for particulates for 1980 and 1981 as well as yearly averages for dustfall from 1977- 1981 (see Tables 2 and 5), clearly indicate that the high level of particulates is a problem throughout the city, and not only on Hamilton Beach, or the industrial sector. A graph (see Figure 8 and Table 14) of the average yearly dustfall for 20 monitoring stations for 1981 versus their rank with regards to proximity to industry indicates the following:

- all areas of the city (except two) have dustfalls above the MOE objective.
- the average dustfall tends to increase with proximity to the industrial sector.

The dustfall level on Hamilton Beach is similar to that experienced in the following neighbourhoods:

Parkview East	Crownpoint East	Landsdale
Parkview West	Crownpoint West	Beasley
Normanhurst	Stipeley	North End East
Homeside	Robson	Kirkendall North

Although the North Park station monitored a higher concentration of sulphur dioxide than the Barton/Sanford station, both readings were below the MOE objective. The difference between these two concentrations is only .004 ppm which is quite a minute amount and therefore does not significantly differentiate Hamilton Beach from neighbourhoods in the vicinity of the Barton/Sanford monitoring station.

The difference in total reduced sulphur between the two major stations is also not statistically significant, although the readings at the Barton/Sanford station did exceed the objective 45 times whereas at the North Park station this occurred only 20 times.

The MOE states that both sulphur dioxide and nitrogen dioxide are not problem pollutants in Hamilton. They occur in very low concentrations and the criteria is hardly ever reached.²³

The readings for oxides of nitrogen were below the objectives at both monitoring stations. Fluoridation is measured at quite a few stations and the data reveals that the objectives are most often at stations located close to the industrial area, more specifically at the following stations:²⁴

- North Park (no. 29008)
- Beach rd/Conrad (no. 29054)
- Queen Elizabeth Way near Beach cutoff (no. 29058)
- Burlington/Gage (no. 29059)
- Briarwood School and King E. (no. 29062)
- Killarney/Beach Blvd (no. 29066)

Health Effect of Air Pollution

How does air pollution affect our health ? The air we breath

is hardly ever free of pollutants; once inhaled the pollutants may react with various tissues in our respiratory system. Some pollutants are more active than others which simply attach themselves to tissues in the lungs. Many studies have investigated the effects of individual pollutants on human health. A detailed discussion on these effects is presented in Appendix C. In most studies subjects are individuals who are exposed to high concentrations of pollutants during the course of their work. The task of demonstrating health effects of ambient or surrounding air is quite difficult since there are more than one pollutant present and they usually occur in much lower concentrations than those found in studies.²⁵ There is no doubt that individuals suffering from chronic respiratory diseases or cardiovascular diseases can be adversely affected when exposed to poor air quality.²⁶

It must be kept in mind that the way in which air pollution is measured is somewhat inadequate for relating it to health effects because of the following reasons:²⁷

- Some measurements relate to emissions and not air pollution; they are related but not closely.
- Monitoring equipment may not be reliable and can be inaccurate.
- There may not be enough air monitors in an area to give an appropriate sampling.
- Even when the above conditions are minimized, there may not be any reliable data from previous years. Some harmful effects may take years to develop and pollution records may not be available over such long periods of time.
- Accurately monitoring air pollution does not in any way measure an individual's exposure to it. This depends on the individual's lifestyle, working place, residence,

and leisure time activities. Many studies relate health effects and ambient air pollution, but most people, especially in Canada, spend a lot of their time indoors where the composition of air can be different. "Exposure is a characteristic of individuals rather than areas".²⁸

The next section serves as an example of what can happen to air quality and human health when adverse meteorological conditions dictate a long period of smog.

Donora: An Example of Potential Pollution Hazard

Donora is a little industrial community situated in a narrow valley just outside Pittsburg, Pennsylvania. Its industries consist of a steel and wire plant built in 1900 and a zinc plant built in 1915 that produces zinc, cadmium, unrefined lead and sulphuric acid. In the nearby area there are two steel companies and a byproduct coke plant in Monessen, a steel and byproduct coke plant in Clairton, a glass company in Charleroi and a power company and railroad yard in Elrama.

On October 26, 1948, an extended reversal of air temperature gradations began and the result was an atmospheric lid. This inversion prevailed for six days, trapping all gaseous wastes. The situation was so bad that 5,910 (42.7% of the population) people were affected by the smog to some degree and 20 of them died.²⁹ Sex, race, occupation, length of residence in the area or degree of physical activity were not factors related to the incidence nor severity of affection. Incidence and severity both had a direct relationship with increasing age. The only significant factor among those who died was the existence of cardiorespiratory disease previous to the smog episode.³⁰

Among those who suffered, "cough was the predominant single symptom during the illness."³¹

The combination of atmospheric stagnation and a very high degree of atmospheric stability was found to be the only necessary and sufficient condition for the accumulation of air pollution in that valley.³²

This example was the first forcible evidence in the United States that man is overtaxing his environment through technological excesses. In 1952 London suffered a similar episode. During four day, London's fog affected many people especially those with cardiac and/or pulmonary diseases.³³

Odour and Air Pollution

People in general tend to assign an important role to the aesthetics of pollution more so than would be thought. Odour is the most reported complaint and in the United States comprised the most investigations in a single category for controlling agencies.³⁴

The sense of smell involves a chemical process. The odour stimulates receptor cells situated in the ceiling of the inner nose. The whole reaction is quite complex. Odour does not cause illness or disease although offensive odours might lead to nausea.³⁵ Generally people will have varied reactions to a given odour. What might be pleasant for one might be unpleasant to another. Odours judged by all to be unpleasant will cause annoyance but they are not harmful.

Odours usually follow air movement so that an odour might be present at one time but after a change in the direction of air flow, it may disappear. There are a couple of problems which hinder the control of odours:

- An unfamiliar odour is more easily detected than a familiar one and can give rise to more complaints.
- Olfactory nerves may become fatigued and people can get accustomed to most odours.³⁶

Although the human nose is the only measuring device it is a most undependable one. Time and place contribute to the complexity of the odour problem. A person can probably put up with an odour at work but will not tolerate it in or around his home.

A reassuring characteristic of odours of chemicals is that their unpleasant odours can be sensed at concentrations below those at which a harmful effect can occur.³⁷

Air Pollution Effects on Inert Material

Air pollution affects our health and clearly affects our surrounding environment. Acid precipitation in Ontario for example has claimed the lives of many of our lakes and continues to pose a threat on both terrestrial and aquatic life.³⁸ But the effects of air pollution do not end there. Inert or non-living materials are also affected by air pollution basically through either soiling or deterioration.³⁹ Dust and other airborne particles settle on buildings and soil them; other pollutants increase the level of acidity in the air which then corrodes certain substances. Here is a brief description of the

effects of various pollutants on inert materials.

Effects of Nitrogen Oxides

Both field studies and laboratory studies have been conducted to observe the effects of nitrogen oxides on inert materials. Textile dyes used on acetate rayon, cotton, and viscose rayon will fade upon exposure to nitrogen oxides. Nylon can be damaged when a combination of unfavorable weather and nitrogen dioxide produce acid aerosols. Stress-corrosion failures of nickel brass wire springs have been reported by telephone companies and were found to be due to high levels of particulate nitrates.⁴⁰

Effects of Ozone

Ambient air concentrations of ozone are sometimes high enough to chemically alter many organic polymers such as rubber, natural and synthetic textiles.⁴¹ Ozone can crack rubber products that are under tension. Certain preventive measures have been taken to alleviate this problem: the use of saturated rubber molecules; the use of a wax inhibitor; and the use of paper or plastic wrappings.⁴²

Deterioration of fabrics and textiles by pollution is additive. This process can be accelerated through deterioration by changes in temperature, humidity, oxygen, sunlight and biological organisms.⁴³ Ozone specifically attacks the cellulose in textiles and light and humidity are important factors necessary to affect the fiber breaking strength.⁴⁴

Effects of Sulphur Oxides

Highly reactive sulphuric acid is produced when sulphur dioxide combines with water vapor in the air and this acid is the cause of much damage. Paints are affected by high concentrations of sulphur dioxide. A newly painted surface will require a longer drying time if exposed to sulphur dioxide concentrations of one to two parts per million. Sulphur dioxide can also affect paint films by rendering some softer and others harder and thus influencing their subsequent durability.⁴⁵ A hardened painted surface will resist the absorption of high concentrations of gases.

Sulphur dioxide is an important contributor in the corrosion rates of metals. Its effect is also mediated by factors of high humidity and temperature. Surfaces which trap and pond water or cool by radiation will experience an increase corrosion rate two or more times the atmospheric average for that specific locality.⁴⁶ Builders must take these factors into account when considering the necessary corrosion protection. Stoker and Seager report the following correlation regarding metal corrosion:

- "1. Increased corrosion rates occur in industrial areas;
2. Corrosion rates are higher in the fall and winter seasons when particulate and sulphur oxide pollutants are more concentrated because of fuel combustion used for heating."⁴⁷

High concentrations of sulphur dioxide can attack a wide variety of building materials especially carbonate substances such as limestone, marble, roofing slate and mortar.⁴⁸ The reaction involves a conversion of the carbonate to sulphates

which are water soluble!

Fabric with a lesser capacity for sulphur dioxide absorption will be least affected by this pollutant. Animal fibers such as wool are more resistant to acidic gases than textiles made from vegetable sources. The latter lose their strength when exposed to acids.⁴⁹ Leather and paper both absorb sulphur dioxide and consequently are weakened and become brittle.

Effects of Particulates

The extent and type of damage caused by particulates such as dust, fumes and mist, vary depending on their chemical and physical characteristics. Damage can be either passive or chemical.

Passive Damage

The deposit of inert particulates results in soiling and creates a need for more cleaning. It is the cleaning process which weakens the material. This is frequently the case with soiling of textiles.

Chemical Damage

The particulates in this case are corrosive or carry corrosive substances. Textiles such as cotton, linen and rayon are examples of vulnerable materials damaged by the attack of particulates having an acidic content.⁵⁰

Paint that is still wet or tacky offers a receptive surface for dirt which then forms a focal point for gaseous absorption and continued attack.⁵¹ Some particulate mists and fumes attack dry painted surfaces and their effects can be seen on cars parked frequently near heavy industries.⁵²

Particulates themselves can be tarry, sticky and acidic especially in cities where large amounts of coal and sulphur bearing oils are used. In this case particulates attach themselves easily to various surfaces where they become miniature acid reservoirs for corrosion.

Most preventive measures can only be taken by the industries which emit pollutants. Their abatement programs will affect the ambient air quality in general. Preventive measures can be directed towards builders; the National Research Council studied the composition of atmospheres in various cities across Canada and this information can help builders select appropriate construction materials for a particular environment.⁵³

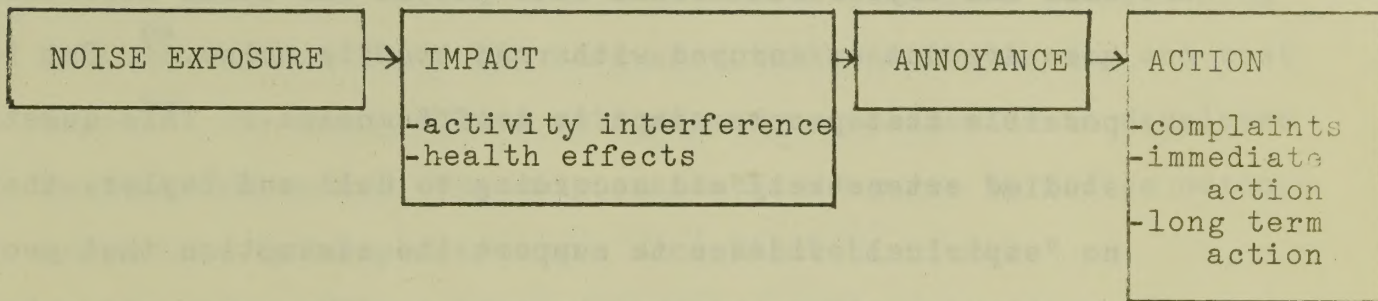
Noise and its Impact on People

Noise in our society has increased to the point where it is now recognized as a pollutant in the Environmental Protection Act mainly because of its adverse effects on humans in two areas:⁵⁴

- Activity Interference: traffic noise levels can interfere with activities such as relaxing, watching TV, eating, working, sleeping and speaking.
- Health Effects: sleep disturbances, headaches and tension can result from high noise levels. These important effects are difficult to isolate.

The impact of unwanted noise levels causes residents to be annoyed. Action taken as a result of this annoyance is usually in the form of complaints. Hall, Taylor and Birnie have designed

a conceptual model of human response to noise as follows:⁵⁵



The exposure to and impact resulting from a high noise level are significantly related to the annoyance felt by individuals but this is no simple cause and effect relationship. Usually health effects are more strongly related to annoyance than activity interferences.⁵⁶ The emotional response of annoyance not only depends on the stated impacts but is also dependant on:

- "1. Feelings about the necessity or preventability of the noise;
2. Judgement of the importance and of the value of the primary function of the activity which is producing the noise;
3. Attitudes about the environment;
4. General sensitivity to noise;
5. Belief concerning the effect of noise on health;
6. Feelings of fear associated with the noise."⁵⁷

It is clear then that annoyance results from a complex interaction of many variables. It is reported that annoyance is only weakly related to complaint action. In other words, it is possible that even though a community experiences much annoyance due to road traffic noise, they might not take any action⁵⁸ and vice versa; the fact that complaints are not

expressed, does not necessarily indicate lack of annoyance.

Exposure to the noise is also another important variable. Hall and Taylor have found that people who spend less time at home are not as annoyed with road traffic noise.⁵⁹ But is it possible that people adapt to traffic noise? This question was studied extensively and according to Hall and Taylor, there is no "empirical evidence to support the assumption that people in residential areas impacted by road traffic noise are able to adapt to noise over time."⁶⁰ They explain that this may be due to the fact that noise levels have increased significantly at each of the residential sites they researched, and the adaptive capacities of the residents were exceeded.

Attitudes and response to road traffic noise is significantly affected by measures used to decrease the noise levels. We will therefore demonstrate the various techniques for noise abatement and follow with a discussion on response to noise after implementation of these various measures.

Noise Control Measures

The need to implement noise control measures has been established. These measures refer to methods used in order to lower indoor and outdoor noise levels to acceptable limits. Noise control measures can be implemented through four techniques:⁶¹ site planning; acoustical barriers; architectural design; and construction techniques.(see Figure 9)

Certain techniques are best implemented during certain times in the planning process. Figure 10 indicates the various noise control measures used to reduce indoor and outdoor noise levels

and their timing in the planning process. Indoor noise levels are generally affected by outdoor noise control measures. A larger selection of measures is available early in the planning process and are generally more acceptable aesthetically and cost less.⁶² Our concern lies with measures implemented in developed residential areas. The only available measures to reduce outdoor noise in a developed area are acoustical barriers.

Acoustical Barriers

A noise or acoustical barrier is a "planned physical structure which is placed between the noise source and the noise sensitive area to reduce undesirable sounds to acceptable levels."⁶³ The effectiveness of the barrier depends on how well it meets the specifications as follow:

- It must be solid, continuous and dense;
- It must be high enough to redirect or reflect sound waves;
- It must have a surface density of at least 15 to 20 Kg/m²;
- It should be in close proximity of either the noise source or the noise sensitive area, preferably the former.⁶⁴

Barriers offer protection not only from noise but also from road dust, salt, roadway debris, intrusion caused by headlight, and offer privacy, security and a psychological benefit.⁶⁵ Earth berms and walls are the two basic types of acoustical barriers.

Earth Berms

They are long and sloping mounds of earth that run parallel

to a highway or road. Berms can be up to 15 feet in height and have widths that are usually six times their height; evidently they require a considerable amount of land for their construction. Earth berms possess the following advantages:

- They deflect sound waves upwards;
- Their surface absorbs some sound waves reducing the effect of reflected sound waves;
- They easily meet the density specifications;
- They are aesthetically more pleasing than walls.⁶⁶

The cost of an earth berm is less than that of constructing a wall if there exists enough space and if there is enough earth readily available for its construction. Berms are expensive to maintain since they are usually sodded and require mowing as well as cleaning up debris and controlling the growth of weeds.

Barrier Walls

Acoustical walls constructed under the specifications mentioned above offer the following advantages:

- They require a minimum amount of space;
- They are very easy to maintain;
- They offer a very strong physical separation of the noise source from the residence.⁶⁷

Walls are usually made of concrete but can also be built of brick, timber and sheet metal. The main disadvantage of a wall is that it is not aesthetically appealing. Walls can be used in conjunction with berms to supplement the height of the berm.

The overall cost of acoustic barriers is affected by conditions other than their construction cost. Acoustic barriers aligned in a north-south direction and at right angles with prevailing winds, provide a situation for increased snow accumulation and therefore increased maintenance cost. Barriers also interfere with drainage therefore requiring the construction of additional underground storm sewers or drainage ditches. Figures 11, 12 and 13 are examples of various acoustical barriers. Table 15 describes noise barriers that were constructed in Toronto in 1972, and their individual costs.

Acoustical barriers reduce outdoor noise levels which results in lower indoor noise levels. Noise control measures specifically directed at reducing indoor noise levels can be implemented in a developed area. They are not highly recommended since they can only reduce indoor noise. These measures include the following:⁶⁸

Blank Walls

Walls exposed to sources of high noise levels should be windowless. A significant reduction in indoor noise levels can be achieved if windows are removed and the wall filled in. The restriction imposed is the problem of relocating a window in order to achieve good ventilation and lighting.

Rooms and Corridors

Rooms that are less sensitive to noise should be situated adjacent to walls exposed to high noise levels. Closets, storage rooms, corridors, and stairways are not sensitive to noise;

bathrooms and kitchens are slightly sensitive areas; whereas bedrooms, living rooms, and dens are sensitive. Rearranging rooms in a house as a noise control measure is quite a laborious and expensive endeavour.

Acoustical Treatment of Walls, Windows, Doors and Roofs

Walls offer better sound insulation if the air space is made wider and more insulation material is added. Windows can be treated acoustically by sealing the windows in the wall, reducing the size of the windows, increasing the glass thickness and using double glazed windows. Doors can also contribute to the reduction of indoor noise levels by using doors having a solid core, by the addition of screen doors, and by the use of double doors. Roofs are usually constructed of materials that provide adequate sound insulation.

Air Conditioning and Ventilation

Air conditioning can be used as a means to deal with problems of ventilation resulting from the use of blank walls and sealed windows as noise control measures. If an air conditioner is installed the residents will not have to expose themselves to high outdoor noise levels resulting from open windows.

The above methods can be quite expensive and only affect the noise level indoors. Shielding is a most favored and the most effective method since it reduces outdoor as well as indoor noise and provides a strong psychological barrier between the noise source and the residents. The fact that residents cannot see the noise source significantly affects their perception of the

noise. The reported effectiveness of a barrier is greater than its actual noise reduction effect. Hall and Taylor found that even though measurable noise levels were identical, residents living in a shielded area reported significantly less disturbance than those living in directly exposed areas.⁶⁹

They also found that the use of air conditioning does not have a significant effect on reactions to noise.⁷⁰ Efforts should be directed at lowering noise levels both indoors and outdoors. Aesthetics of barriers are also more important than the specific reduction they offer. Hall and Taylor's results indicate that a tree screen had more "impact effectiveness" than a concrete wall.⁷¹ More research in this area is needed to specifically study the question of whether an aesthetically pleasing barrier can improve attitudes even more than a regular acoustical barrier.

Figure 14 describes the various methods of noise control, their application (indoor or outdoor noise control), their timing of application in the subdivision planning process, general cost considerations and their advantages and limitations.

Road Traffic Noise

Sound is measured in units called decibels (dB). Figure 15 lists various noise sources, their emitted sound level and the reactions they induce. Since noise is not always at a constant level, different noise level limits are used as descriptors. These values are known as Ln values and are defined as the noise level (l) exceeded n% of the time.⁷² For example, L50

would be the noise level exceeded 50% of the time. Another descriptor used quite often is Leq; this represents the level of a constant sound which has the same energy as the actual time-varying sound.

High noise levels can have adverse effects on human beings. It is necessary then to set sound level limits in order to identify noisy environments and implement noise control measures. In 1971 the Environmental Protection Act was amended in order to allow municipal councils to pass noise control by-laws that would ensure the protection and conservation of the natural environment. The Model Municipal Noise Control By-Law was set up by the MOE to serve as a guide for municipalities. It consists of two parts, part one being a more subjective or qualitative approach to noise control. Part two is a more comprehensive and technical format of the by-law.⁷³ Table 16 describes sound level limits for indoor and outdoor areas set by the Model Municipal Noise Control By-Law.

Noise levels from road traffic can be calculated. Any combination of the following conditions determine the noise level from road traffic:⁷⁴

- Average vehicle speed;
- Density of traffic flow;
- Proportion of trucks;
- Number of lanes
- Distance from the roadway'
- The gradient of the road;
- The surface of the road.

In a publication called Road and Rail Noise, the Central Mortgage and Housing Commission details the procedure for calculating road traffic noise through the use of different tables. These road traffic noise tables were developed by the MOE. If a residential area is found to be exposed to high noise levels from a highway, the Ministry of Transportation and Communications must provide noise control measures for a proposed highway or expansion of a highway in a developed residential area. The attenuated sound level to be achieved should be as low as technically and economically feasible below 70 dB.⁷⁵ The responsibility for lowering noise levels on Hamilton Beach lies with the Ministry of Transportation and Communications. Figure 16 describes the method for calculating the attenuation of a barrier.

Noise Levels in Hamilton

The Queen Elizabeth Way is the major source of noise pollution on Hamilton Beach; Beach Boulevard is the second source. Traffic volumes are very high on this highway; 12% of the total volume of traffic consists of trucks.⁷⁶ During the course of the environmental assessment study on the Queen Elizabeth Way (QEW) expansion, noise measurements were taken at thirteen different locations along the highway between Guelph Line and Highway 20. The descriptor used was L10, i.e. the noise level exceeded 10% of the time.

As can be seen from Table 17, the maximum level recorded was 82 dB and the minimum was 57 dB. Readings were taken in 1978 in

a few selected locations and were not found to be significantly different from those measured in 1973.

Noise levels across Hamilton Beach tend to be high. At some locations, however, noise levels tended to increase with distance away from the QEW. Two explanations account for this effect:⁷⁷

- The Skyway bridge can act as a sound barrier in that area (location no. 8);
- The greater the distance from the QEW, the smaller the distance from Beach Blvd and consequently the noise from Beach Blvd more significantly affects the reading than that coming from the QEW (location 10 and 11).

The expansion of the QEW obviously entails a higher traffic volume resulting in higher noise levels emanating from that source. Provisions have been made for the construction of a noise barrier. Although the environmental assessment report indicates that a berm will be constructed, the barrier will most probably be an acoustical wall since an earth berm would require transporting a great deal of earth into the area and using a lot of property to construct the berm.

The construction of the noise barrier is foreseen as part of Stage Two of the expansion program, which will take place quite some time in the future.⁷⁸ Noise from the construction of the arterial road (Stage One) will contribute to the increase in noise level before the construction of the barrier.

In 1972, the MOE conducted a noise survey in Hamilton.⁷⁹ Comparing noise levels recorded on Hamilton Beach and those from the noise survey, the data clearly indicate that Hamilton Beach experiences noise levels comparable to those in the

following areas:

- Residentail/commercial areas;
- Commercial/downtown areas;
- Industrial/residential areas. (see Table 18)

Many other areas in Hamilton experience high noise levels but on Hamilton Beach noise levels can and will eventually be reduced by the construction of a noise barrier. The shielding will have a positive effect not only as far as measurable noise levels but will also be a great psychological barrier. The barrier will separate the residents from the highway and will somewhat shield the view of the industries. Whereas on Hamilton Beach residents can look forward to improved conditions in this area, residents in neighbourhoods experiencing similar high noise levels cannot since it is impossible to construct acoustical barriers throughout the city.

Conclusion

Given the multitude of facts and figures on air and noise pollution, what can be concluded about the status of Hamilton Beach ? The situation is not as clear as Project 36 leads us to believe. "Human response to air quality is multi-dimensional";⁸⁰ many variables such as perception of air quality come into play. In a study by Flachsbart and Phillips, results indicated that people have bacome accustomed to poorer air quality and are not considering it as important as they used to. Furthermore they found that clean air is of less importance to people who have

more pressing needs as measured by income.⁸¹ If people cannot afford to move then, they will put up with poorer air quality.

Data on air and noise pollution do show that the situation on Hamilton Beach is comparable to that found in residential areas near the industrial sector. This does not mean that the air quality is very good but it is definitely not poor enough to condemn Hamilton Beach as a permanent residential area. Similar results are found with noise pollution; they indicate that noise levels on Hamilton Beach are high but so are the noise levels in other areas of the city. Residential areas can be seen all along the QEW from Toronto to Niagara Falls. Developing residential areas near highways is now a recognized fact.

The data indicates that air and noise pollution are not distinguishing features of Hamilton Beach and this area can exist as a thriving residential sector.

FLOODING ON HAMILTON BEACH

Two major criteria used by the Province of Ontario to determine the suitability of Great Lakes shoreland for public acquisition and controlled development are: the degree to which land is subject to flooding from the lake; and the degree to which public and private property is subject to damage from flooding. Provincial policy holds that Great Lakes shoreland should be acquired by municipalities and developed as open space/recreational land if it is subject to flooding and if the risk of property damage from flooding is high.⁸² On the other hand, if shoreland is not subject to flooding and if the risk of property damage is either non-existent or low, municipalities have the opportunity to use a variety of shore management strategies and techniques to plan for the highest and best use of their shoreland.

To justify the public acquisition of Hamilton Beach, the City of Hamilton and the Hamilton Region Conservation Authority maintain that the land comprising Hamilton Beach is subject to flooding. In more precise terms they state that Hamilton Beach is becoming increasingly less suitable for permanent residential use, one of the reasons being "the serious health hazards created by fluctuating water levels which result in flooding and the backing up of septic tanks."⁸³ Although this argument has been taken in the past and is still adhered to, no research to date has proven that Hamilton Beach is floodprone.

Subsequently, the purpose of this chapter is to analyze the probability of flooding on Hamilton Beach and determine whether

or not flooding constitutes a legitimate justification for the public acquisition of Hamilton Beach by the City of Hamilton. The first section of this chapter briefly describes the characteristics of Great Lakes water levels and floodplains. The second section describes the potential problems associated with residential development in lakeshore areas. The third section of this chapter describes the topographical and drainage characteristics of Hamilton Beach, investigates the probability of surface water flooding in the area, points out potential concerns regarding high water tables and examines potential measures that can be taken to safeguard both new and existing residential development against damage from surface water flooding and high water tables.

The Characteristics of Great Lakes Water Levels and Floodplains

The degree to which Great Lakes shoreland is subject to flooding and high groundwater tables is determined by the characteristics of long-term lake formation and the fluctuation of water levels caused by seasonal climatic considerations and the inflow-outflow characteristics associated with the Great Lakes system.

Water Levels

Since their formation at the end of the Wisconsin continental glaciation period, the Great Lakes have been in a state of constant adjustment to changing conditions of water levels due

to drainage basin configuration, postglacial rebound and climate. Since the melting of the glaciers of the last ice age, the northern portion of the North American continent has been rising relative to the south. In the thousands of years since glacial times, some areas of the Great Lakes have risen several hundred feet. This upward movement of the earth's crust is still taking place with the northeastern portion of the basin rising relative to the southeast portion. Consequently, as time goes on, the water levels along shores situated south and west of a lake outlet will rise while levels on shores situated north and east of a lake outlet will fall. This means that the mean level of Lakes Erie and Ontario will gradually increase and Lake Huron's level will gradually decrease.⁸⁴

Water levels on the Great Lakes also exhibit a regular seasonal cycle. In general, water levels are at their lowest in late fall and winter and at their highest in late spring and summer when the Great Lakes are subject to inflows from melting snow and spring rain.⁸⁵ For example, mean water levels for Lake Ontario can vary as much as .50 metres (1.65 ft.) over the course of the average year. This phenomenon is shown in Table 19.

One aspect of lake levels having a significant impact on both existing and proposed shoreland development is surface-groundwater interface. As the level of a lake rises, there is a corresponding rise in the level of the groundwater table and less distance between the surface of the land and the water table (depth to seasonal high water table).. For example, if shoreland is at elevation 75.00 m. (247.50 ft.) and the level of

the lake is at elevation 74.00 m. (244.20 ft.), there is a distance of one metre (3.30 ft.) between the surface of the land and the water table. However, if the level of the lake rises to 74.50 m. (245.85 ft.), the distance between the surface of the land and the water table is lowered to .50 m. The relationship between the water table and residential development is discussed in the next section of this chapter.

Although lake level fluctuations are primarily controlled by nature, man has also slightly affected them. Lakes Superior and Ontario are artificially regulated by control works at their outlets. Regulation of Lake Ontario has reduced the range of water level fluctuations by almost .50 m. and during the 1970's, kept the peak level about .40 m. (1.32 ft.) lower than would have been the case under natural conditions.⁸⁶

Lakeshore Floodplains

Flooding occurs along the Great Lakes shoreline when lake levels rise above mean levels in either the short- or long-term. Its location and degree depends on two factors:

1. the magnitude of lake level fluctuations; and
2. the elevation of the shorelands.⁸⁷

As previously mentioned, the water levels of the Great Lakes vary from season to season because of changes to water supply to the lakes. During late spring and summer, when water levels are at their highest, shoreland can be inundated by relatively calm lakewater if the level of the lake rises above the level of the shoreland. This type of flooding can persist

for as long as water levels remain above the elevation of the land. However, flooding along the shore is also associated with short-term changes in lake levels caused by storms. During a storm, strong winds are created which begin to blow over the lake. When the wind continues to blow over the lake surface in one direction for a number of hours, a surface tilt is produced (wind set-up) which not only causes inundation to occur farther inland but also threatens inland property with serious wave damage through wave uprush.⁸⁸ The range of set-up varies from lake to lake and depends upon the length of fetch⁸⁹ and water depth. Flooding caused by wind set-up can last a few hours or a few days. In many cases shoreland property is protected from damaging waves by the natural topography of the shore itself, i.e., beach berms.

Unlike watercourses, where floodprone areas are determined and regulated according to streamflow and precipitation characteristics⁹⁰, floodprone areas along Ontario's Great Lakes shores are determined using Ministry of Natural Resource standards for the delineation of floodprone areas. The criteria used in Ontario are the 1:100-year flood and wave uprush levels, defined as the levels due to the combined occurrences of mean monthly lake levels and wind set-up having a total probability of being equalled or exceeded during any year of one percent. These levels are not based on a specified lake level combined with a fixed wind set-up, but represent the total probability of possible combinations of different lake levels and wind set-ups which produce the flood and wave uprush. Statistically, the

1:100-year flood and wave uprush levels do not occur once every 100 years. There is a one percent chance that flooding will occur during any one year, a 22% chance that it will occur during any 25-year period and a 39% chance that it will occur during any 50-year period.⁹¹

Potential Problems Associated With Residential Development in Lakeshore Areas

Before investigating existing flooding problems on Hamilton Beach it is necessary to look at general concerns associated with residential land use in lakeshore areas. In general, there are four concerns: the operation of private sewage systems; basement seepage; surface water inundation; and wave damage.

Operation of Private Sewage Systems

Because many lakefront residences have been or are intended for seasonal use the on-site septic tank and soil absorption/cesspool system is the most widely used sewage disposal system on lakeshore property. In the case of the absorption field, sewage from toilets, showers, waste grinders, sinks, dishwashers and clotheswashers is conveyed to a "septic tank" which conditions the sewage by settling and bacterial decomposition and if sized and operated properly, passes on a relatively clear liquid effluent to a shallow subsurface soil absorption area called the "absorption field" (Appendix D). Here the effluent is discharged into the soil where it is absorbed and acted upon by aerobic and anaerobic bacteria which causes an oxygenizing,

stabilizing and purifying action.⁹² Although cesspools are typically found on many lakeshore properties, they are not as efficient as absorption field systems.⁹³ Cesspools may or may not be combined with septic tanks and therefore, discharge raw sewage or partially treated effluent directly to the soil in a concentrated area surrounding the system. Since the surrounding soil is kept saturated, there is less opportunity for effluent to be further treated by aerobic organisms.⁹⁴

As pointed out in Appendix D, absorption field systems are an adequate and accepted means of treating domestic sewage given the proper amount of unsaturated soil between the bottom of the absorption trenches and the water table. However, if this condition does not exist and the water table is too close to the bottom of the absorption trenches, effluent will not be treated effectively and both the surrounding ground and surface waters could be polluted. If the septic tank itself is below the water table or if it is in danger of becoming submerged, effluent could back up into basements causing unpleasant sanitary conditions and the threat of communicable disease.⁹⁵ Conditions could become more problematic if cesspools are used in place of absorption fields since cesspools are located farther down in the ground. While the bottom of the average absorption trench is located .61 m. (2 ft.) below the surface of the ground⁹⁶, the bottom of the average cesspool is located 2.12 m. (7 ft.) below the surface of the ground.⁹⁷

Basement Seepage

Besides complicating the operation of private sewage

disposal systems, water tables pose a potential threat to the soundness of basement foundations, retaining walls and personal property stored in basements. The most common cause of basement seepage and the deterioration of retaining walls is inadequate drainage. If foundations are constructed below the water table and there is no way of draining water from around foundations, i.e., in the case of highly permeable soils such as sand, water will begin to seep up through the basement floors and act on retaining walls. It is not always appreciated that retaining walls without adequate drainage are subject to substantial hydrostatic pressures, sufficient to cause collapse if they are not designed to withstand such pressures. For example, a 1.2 m. (4 ft.) wall with saturated soil backfill will have a hydrostatic pressure of about 35 kilograms/sq. m. (250 lbs./sq. ft.) at its base.⁹⁸ Under these circumstances the developer would either have to drain excess water away from foundations using building drains or encase entire foundations in watertight enclosures. In either case, foundation waterproofing would add to the development cost of new homes and thus, the cost of purchasing new homes.⁹⁹

Surface Water Inundation and Wave Damage

Not only can the operation of a private sewage disposal system be affected by the water table, it can also be affected by the inundation of land surrounding the sewage system. As previously mentioned, the efficient operation of an absorption field depends on an adequate amount of unsaturated soil being available between the bottom of the absorption trenches and the

water table. If this situation does not exist, and the soil is saturated with groundwater, effluent will not be treated properly. When lake levels are high and shoreland is inundated by lakewater, an existing problem is only aggravated. In this situation effluent actually rises to the surface of the land and "ponds" around the absorption field. In the case of cesspools, raw sewage can actually pond on the surface of the land if the cesspool does not also have a septic tank.

Besides affecting the operation of private sewage systems, surface water inundation and wave uprush can inflict serious damage to both public and private property along the shore. In the case of residences, inundation can seriously damage the structures themselves, contents, surrounding landscape and the public service structures servicing the surrounding area. Where shore property is not protected by natural or artificial barriers, damage can be made worse by the impact of waves.

If residences have basements there will be structural damage when floodwaters rise to within .50 m. of the first floor. At this point the dollar damage to the structure will equal 5% of its total value while the damage to the contents of the basement and first floor will equal 52 and 7% of their value respectively. Similarly, when floodwaters rise to the elevation of the first floor the dollar damage will equal 11% of the structure's value while the damage to the contents found in the basement and first floor will equal 60 and 10% respectively.¹⁰⁰ Where residences have no basements, floodwaters must reach a greater height in order for damage to equal that of residences with basements. For example, when floodwaters

rise to the elevation of the first floor in a residence with no basement, the dollar damage to the structure will equal 7% of its value and damage to the contents on the first floor will equal 10%.¹⁰¹

Another important item is landscape damage. This includes the heaving of sidewalks and driveways as well as the killing of grass and plants. Generally, the damage done to landscaping will equal one percent of the structure's value.¹⁰²

Surface water inundation can also damage public service structures servicing the neighbourhood. Along the Great Lakes shore, roadways are the most common public service structure affected by floodwaters. It has been estimated that damage to roads flooded for one week or less equals \$3,700 per kilometre (\$6,000 per mile) in 1981 dollars.¹⁰³

Existing and Potential Flooding Problems On Hamilton Beach

Water Tables

To begin with, the water table is sufficiently close to the surface of the land in all areas of Hamilton Beach to make residences susceptible to seepage if they have basements and make new development a more difficult procedure. At the present time, there are 283 residences with basements on Hamilton Beach, 125 on the Lakeside and 158 on the Bayside. Residences with basements represent 60% of the structures on the Lakeside and 64% of the structures on the Bayside respectively.¹⁰⁴ Although it is impossible to determine how many residences with basements

actually experience seepage, they are all susceptible to this type of damage.

Because Hamilton Beach is a baymouth sandbar, formed when beach material was shifted by easterly winds from the southern shores of Lake Ontario, it is relatively low lying land and generally uniform in elevation. Subsequently, most of the area is situated at a uniform 75.76 m. (250 ft.) above sea level.¹⁰⁵ Although Hamilton Beach is situated on low lying land, there is enough fluctuation in elevation to warrant its investigation in order to determine the relationship that exists between Lake Ontario water levels, the location of the water table and the depth to the water table. This investigation allows us to locate potential groundwater problems on Hamilton Beach.

As previously mentioned, water tables rise in the same manner as lake levels and both are at their highest during late spring and early summer. This means that if the level of Lake Ontario is 74.87 m. (247.07 ft.) in June, the water table will be at a similar level and the depth to the seasonal high water table will depend on the nature of this surface- groundwater interface

Looking at Table 20 it can be seen that the elevation of Hamilton Beach is higher on the Lakeside and lower on the Bayside. On the Lakeside, elevations generally range between 76.60 m. (252.78 ft.) and 78.20 m. (258.06 ft.), the higher elevations being located in the backyards of individual properties and the lower elevations being located in the frontyards near Beach Blvd. On the other hand, Bayside elevations generally range between 75.40 m. (249.48 ft.) and 77.80 m. (256.74 ft.),

the higher elevations being located near Beach Blvd.

In order to determine whether or not Beach properties have problems with their private sewage systems, it is necessary to determine whether or not there is enough unsaturated soil above the water table to allow sewage systems to operate effectively. This investigation requires analysis of the depth to the water table in the area. Because elevations are higher on the lakeside of Hamilton Beach, the depth to the water table will generally be less on the Bayside and greater on the Lakeside. The depth to the water table will be less on both sides of Hamilton Beach during the spring and summer months.

More specifically, the depth to the high water table can either be determined using the highest mean monthly level for the lake, in this case 74.87 m., or the highest recorded level for Lake Ontario which was 75.60 m. (249.48 ft.) in June, 1952.¹⁰⁶

If the former method is used properties must be at elevation 76.74 m. (253.24 ft.) to have little or no problems with their absorption fields and 78.46 m. (258.92 ft.) to have little or no problems with their cesspools. If the latter method is used properties must be at elevations 76.01 m. (250.83 ft.) and 77.73 m. (256.41 ft.) to have little or no problems with their absorption fields and cesspools respectively.¹⁰⁷

Looking at Table 20, it can be seen that all existing absorption fields on the Lakeside are within these standards and any absorption field installed on the Lakeside at the present time, would also meet these standards.¹⁰⁸ Not only is there

sufficient soil for absorption fields in this area, but also the required 15.15 m. (50 ft.) distance from the lake. Consequently, there has been little or no documented evidence of health hazards existing on the lakeside of the Beach due to poorly operating absorption field systems.¹⁰⁹ There is no need to be concerned about cesspool systems since there are few, if any cesspool systems on the lakeside of Hamilton Beach.

On the other hand, cesspools on the Bayside do not comply with current provincial regulations governing cesspool operation. No where on the Bayside is there .60 m. (1.98 ft.) of soil beneath the bottom of the cesspool system and the water table.¹¹⁰ Subsequently, it is more likely that raw sewage or partially treated effluent is seeping into the water table or ponding on the bayside of Hamilton Beach. However, it must be emphasized that this assumption is only speculation at the present time. There has never been a study conducted to determine the adequacy of private sewage systems on Hamilton Beach and according to the Hamilton-Wentworth Regional Health Unit, there has only been an average of four reported cases of sewage disposal system defects per year on Hamilton Beach since 1978.¹¹¹

Alternatives

Given the current state of the art, it is not economically feasible to waterproof existing basements. Waterproofing existing basements costs between 19 and 50% of the structural value.¹¹² In order to prevent damage from seepage residents should avoid storing valuables in their basements. This action

alone can reduce property damage by 80%.¹¹³ If basements are to be constructed on Hamilton Beach, they will have to be encased in watertight enclosures since the sandy soil has a high absorbency rate and it is difficult to drain excess water through building drains. In most circumstances, waterproofing will add between 4 and 10% to the cost of a new home.¹¹⁴

As previously mentioned, no study has been published showing operational problems with Lakeside absorption field systems. Consequently, it has yet to be proven that Lakeside sewage systems need to be replaced for health reasons. This does not mean the Lakeside residents can sit back and let their sewage systems deteriorate. To maintain their sewage systems in effective working order residents must take steps to insure the proper operation of their septic tanks and absorption fields. Failure to pump out a septic tank when required will result in sludge or scum being carried into the absorption field which in turn may clog and cease to function. In this event, not only will the tank have to be pumped out, but the absorption field will have to be replaced.¹¹⁵

On the other hand, existing sewage systems pose a greater problem for Bayside residents. In the first place, it is always possible for cesspool effluent to pollute the groundwater. In the second place, sewage ponding can be prevented by cleaning cesspool pits and the sludge-saturated soil around them. However, cesspool pits eventually wear out and have to be replaced.¹¹⁶ If and when cesspool pits wear out residents must consider replacing them with alternative private sewage systems. Potential alternatives include: raised leaching beds (absorption

fields), aerobic systems and holding tanks.

1) Raised absorption fields. Where .50 m. of unsaturated soil is unavailable between the bottom of the absorption field and the water table, a solution may be found by elevating the absorption field with soil so that the required amount of unsaturated soil is available above the water table. The Province of Ontario allows this technique to be used when at least .25 m. (.83 ft.) of unsaturated soil already exists above the water table extending for at least 15 m. (50 ft.) beyond the absorption field in any direction that the effluent moves laterally. When installing this system, standard clearance distances must be increased by 2 m. (6.6 ft.) for every m. that the surface of the absorption field is raised above ground level.¹¹⁷

If the highest mean monthly level for Lake Ontario is used to determine the depth to the high water table, the technique can be used on most Bayside properties. If however, the highest recorded level for Lake Ontario is used, the technique can only be employed in areas where there is the required .25 m. of existing unsaturated soil, i.e., between Arden and Lagoon Ave.

As shown in Figure 17, raised absorption fields can be used to treat effluent from adjoining properties as well as single lots. Also, common fields can be used to treat effluent from an entire community. An example of the community system is shown in Figure 18. The cost of individual systems varies widely, depending primarily on the availability and cost of fill and the experience of the contractor. An entire system,

including septic tank, pumping station and mound costs between \$2,000 and \$5,000 (U.S.) in 1979.¹¹⁸

Where raised absorption fields are unsuitable, effluent could be treated at a community package treatment plant. Such plants are useful in providing the temporary treatment of effluent for populations under 10,000 pending connection with larger metropolitan sewerage systems.¹¹⁹ In 1980, the average initial capital cost of an extended aeration package treatment plant (design population of 1,260), was \$125,000 while the yearly capital and operating/maintenance costs amounted to \$33,200.¹²⁰

2) Aerobic systems. Like septic tank systems, aerobic systems require .50 m. of unsaturated soil between the bottom of the absorption field and the water table. When a raised absorption field is used there must be .25 m. of undisturbed soil beneath the bottom of the absorption field. Consequently, aerobic systems utilizing raised absorption fields, might only be used in certain areas of Hamilton Beach.¹²¹

However, where used, aerobic systems produce an effluent of higher quality than that discharged from septic tanks and lessen the danger of groundwater pollution. For example, aerobic tanks reduce Biochemical Oxygen Demand (BOD) by 85-98% compared to 25-65% for septic tanks.¹²²

Aerobic tanks for on-site treatment of domestic wastewater are available commercially in one, two and three compartment designs. Some designs provide a sand filter to provide polishing of effluent. In general, wastewater entering the aerobic

mini-plant accumulates in an aerated chamber for a prescribed period of time. After aeration, the wastewater is allowed to settle, either in a separate chamber or by automatic shutdown of aeration devices in the holding chamber. Thereafter the effluent is pumped to the absorption field.¹²³ An example of the aerobic tank system is shown in Figure 19.

Aerobic tanks cost more to install and operate than septic tanks. Where septic tanks cost between 12 and 18 cents per litre to install and 12-18 dollars per year to operate, aerobic tanks cost between \$1.35 and \$2.70 per litre to install and 120-210 dollars per year to operate.¹²⁴

3) Holding tanks. In areas where raised absorption fields are not practical, residents can use holding tanks as an alternative solution. Holding tanks are used to receive and store sanitary sewage until a transport vehicle removes the wastewater to an authorized disposal site. Holding tanks can either be located above or below ground and work best in areas where the elevation of the land allows sewage to run from the house to the tank by gravity.

In Ontario, the working capacity of a holding tank cannot be less than 9,000 litres (1,980 imperial gallons).¹²⁵ The annual cost to install and operate a 13,368 litre (3,000 gal.) holding tank is approximately \$979 per year.¹²⁶

No matter which alternative is used, residents must obtain a certificate of approval from the Regional Health Unit before modifying or replacing their existing sewage systems. In the case

of holding tanks, residents must also obtain a permit from the Regional Municipality and pay a \$2.50 fee for every 2,500 litres (561 gal.) brought to the Woodward Ave. treatment plant.¹²⁷

Inundation and Wave Damage

According to standards used to delineate flood prone land in Ontario, the 100-year flood level is 76.20 m. (251.46 ft.) and the 100-year wave uprush level is 77.10 m. (254.43 ft.) along the shores of Hamilton Beach.¹²⁸ This means there is a one percent chance that the shores of Hamilton Beach will be inundated to an elevation of 76.20 m. and threatened by wave damage to an elevation of 77.10 m. during any given year.

To determine the flooding potential on Hamilton Beach given the above standards, it is necessary to look at the natural and man made features existing in the area.

In the case of the Lakeside, it should be pointed out that the foreshore area of the sand beach has a uniform elevation of 76.0 m. (250.80 ft.) while the middle of the beach has a uniform elevation of 77 m. (254.10 ft.). In between the Canadian National Railway embankment (situated on the backshore) and the middle of the beach, there are extensive areas of higher elevation. Elevations in these areas range between 77.80 m. (256.74 ft.) and 78.40 m. (258.72 ft.) up to Manor Ave. where they begin to taper off to 77.10 m. in the vicinity of 1049 Beach Blvd. The elevation of the C.N.R. embankment itself ranges between 77.40 m. (255.42 ft.) and 77.60 m. (256.08 ft.).¹²⁹

On the Bayside, the elevation at the bayfront is generally uniform at 76 m. However, it must be pointed out that the Queen

Elizabeth Way (Q.E.W.) protects properties from bay waters up to 936 Beach Blvd. The elevation of the Q.E.W. roadbed ranges between 77.40 m. at the Windermere Cutoff and 77.60 m. at 936 Beach Blvd. where the highway rises to meet the Burlington Skyway Bridge. Although bayfront elevation is uniform up to the canal, there are areas of higher elevation farther inland. In between the bayfront and the Q.E.W. the elevation of the land ranges between 76.20 m. and 76.70 m. (253.11 ft.).¹³⁰

Given the natural and man made protection available to both sides of Hamilton Beach, it is difficult to see how flooding can occur in the area on a predictable basis. Neither lake water under calm conditions nor waves during periods of wind set-up are able to reach Beach properties during normal high water or storm conditions. Consequently, it is impossible to classify Hamilton Beach as floodprone land given current provincial standards.

The 1973 Flood

Although inundation is a rare occurrence and wave damage is nonexistent on Hamilton Beach, inundation can take place on the Lakeside under unusual conditions. In order for lake water to overtop the C.N.R. embankment, high water levels must combine with high wind velocities and a long fetch to produce abnormally severe wave action.

On Lake Ontario, the storm of April 7-11, 1973 produced these conditions and was responsible for moderate, short-term flooding on Hamilton Beach. During this period, water levels of 75.47 m. (249.10 ft.) combined with northeasterly winds

reaching velocities of 33.48 km./hr. (54 mi./hr.) to produce waves up to 3 m. (10 ft.) in height.¹³¹ Despite their inability to inflict damage to Lakeside residences, waves were of sufficient height to overtop the railway embankment and spill water onto Lakeside properties. As the land slopes down towards the Q.E.W. excess water flowed towards Bayside sidestreets, hit the highway embankment, backed up along the sidestreets and caused short-term damage to basements and private sewage systems.

It is important to note that the storm drainage system plays an important role in the occurrence of periodic flooding in the area. Storm sewers on Hamilton Beach drain the road network only, as individual properties do not have building drains hooked up to the system. Catch-basins and drainage ditches are found primarily on Beach Blvd, although a limited number of these collectors are located on sidestreets. The number and location of sidestreet storm sewer collectors are shown in Table 21. Storm water drains into ditches (located on the west side of the Q.E.W.) and Hamilton Bay from eight locations. Storm water drains into ditches from just south of Fletcher Ave; Bayside Ave; the Q.E.W. Cutoff and Lagoon Ave. and directly into the Bay from Grafton Ave., Dunraven Ave., two properties south of Manor Ave. and the amusement park area.¹³²

Normally, a properly maintained drainage system is capable of removing moderate amounts of excess water from city streets. However, the drainage system on Hamilton Beach is old, the adequacy of its maintenance is in doubt and the system may or may not be

adequate to remove excess water from area streets in its present condition. For example, the present system is at an elevation similar to the Bay. High water levels combined with storm water can create a situation where water needs to be drained at a faster rate than it can flow by gravity to bayfront ditches and the Bay itself. This situation is aggravated by storm sewer outlets that have probably silted up over time.¹³³

Even though there was short-term flooding on Hamilton Beach in 1973, the dollar damage to public and private property in the area was low compared to other areas along the shores of Lake Ontario. Looking at Table 22, it can be seen that the total dollar damage along the Hamilton-Burlington Beach reach was among the lowest sustained as a result of the storm conditions of 1972-1973. When controlling for the length of shoreline, Hamilton-Burlington Beach sustained dollar damages that were lower than a number of other populated reaches along Lake Ontario.

Alternatives

As research shows, Hamilton Beach cannot be classified floodprone given current provincial standards. Since Hamilton Beach is not floodprone and regulated as such by the Hamilton Region Conservation Authority (Appendix F), the City of Hamilton should avoid using the flooding concern as justification for acquiring Beach property.

Although short-term inundation can take place during extreme weather conditions, property damage can be reduced, if

not totally prevented, by certain actions. These involve shore protection, storm drainage and residential design modification (floodproofing).

1) Shore protection. At the present time, Hamilton Beach is adequately protected by the natural topography of the sand beach and the C.N.R. embankment. If these features are left as they are, Hamilton Beach will be protected from most storm conditions. If these features are modified or removed however, alternative long-term shore protection will be required, i.e., floodwalls. Since the estimated cost of these works would be over \$2 million, it is preferable to leave the beach and the railway embankment in their present condition.¹³⁴

2) Storm drainage. Improving the existing storm drainage system would greatly reduce the risk of sidestreets being turned into canals during periods of short-term inundation. This could be accomplished by enlarging existing storm sewer outlets and extending them out into the Bay.

It should be noted that the Ministry of Transportation has plans to improve storm drainage in the area by enlarging and extending storm sewer outlets that now drain into ditches on the west side of the Q.E.W. These improvements will be made prior to constructing the arterial road. Storm sewer pipes that now measure .61 m. (2 ft.) in diameter will be enlarged to 1.21 m. (4 ft.) and 1.52 m. (6 ft.) and extended out into the Bay.¹³⁵ According to Dillon Consulting Engineers and Planners, the enlarged storm sewer outlets will improve storm drainage on Hamilton Beach in the vicinity of the proposed Eastport

Industrial Park.¹³⁶

It should also be kept in mind that the Regional Municipality has an obligation to investigate drainage problems on the Region's streets. If a severe problem is found to exist, additional drains will be installed on the streets in question.¹³⁷

3) Floodproofing. New and existing residences can be protected from short-term inundation by modifying their design. When existing structures have no basements the closure and seal method of floodproofing can be used to prevent damage up to .61 m.¹³⁸ This method uses closure panels and flood shields to prevent water from entering windows and doors and costs approximately 12% of the structural value of the house.¹³⁹ An example of the closure and seal method of floodproofing is illustrated in Figure 20. With new structures, damage can be prevented by elevating structures on fill above flood levels. This is the most popular method of floodproofing in Canada and costs between two and four percent of the structure's value.

With basements, the cost of elevating on fill and waterproofing the basement will range between 6 and 14% of structural value.¹⁴⁰

It must be pointed out however, that the decision to use floodproofing techniques is always preceded by cost-benefit analysis. If anticipated damage reduction in dollars exceeds costs amortized on an annual basis, floodproofing is economically justified. If floodproofing is found to be technically and economically feasible, application can be made to Environment Canada for Demonstration Project funding.¹⁴¹

In order to determine whether or not they are allowed to floodproof their homes, residents should consult the City's Zoning By-Law (Appendix G) which spells out the use, height, area and distance requirements necessary to obtain a building permit in districts zoned Urban Protected Residential.

Summary: Flooding On Hamilton Beach

As research shows, the flooding concern should not be used by the City of Hamilton to justify the public acquisition of Hamilton Beach. Hamilton Beach cannot be classified flood prone since neither inundation nor wave uprush occurs in the area on a regular, predictable basis. When properties are inundated by lakewater, it is short-term in nature and causes relatively minor damage. Damage can be greatly reduced if not totally prevented, by incorporating floodproofing measures in the design of both existing and new residential structures and improving the existing storm drainage system in the area.

Where residences have basements, there is always the potential for seepage. Since there is no economical way to waterproof existing basements, homeowners should avoid storing valuables in their basements and should have their homes checked periodically for structural soundness. If new residences are built on Hamilton Beach, basements will have to be waterproofed. At the present time, this procedure can be undertaken at reasonable cost.

By studying the contours of the land and the characteristics of the existing sewage systems in the area, it can be seen that

if sewerage problems do exist, they are occurring on the bayside of the Beach. Even then, sewerage problems can be corrected. Usually, malfunctioning systems can be corrected through cleaning and proper maintenance. When cesspool systems wear out they can be replaced with improved subsurface systems or holding tanks.

However, without in-depth study, it is impossible to say that existing sewage systems pose a serious health hazard on Hamilton Beach. According to the record, there are few instances of sewage system defects reported to the Regional Health Unit during the course of the average year.

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out they can be replaced with improved construction system
holding tanks.

However, a large in-depth study is necessary to see
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PUBLIC SEWERAGE ALTERNATIVES FOR HAMILTON BEACH

Collection and treatment of wastewater is a necessity because of the importance of controlling pollution in streams, waterways and lakes. The responsibility for sewage disposal lies with the Regional government. In Hamilton there is a network of 262 km. of gravity sanitary sewers serving developed areas.¹⁴² This system of sewers converges on the pollution control plant on Woodward avenue. The plant has a capacity of treating 273 million liters a day (MLD) and serves the population of Hamilton, Stoney Creek and Ancaster.¹⁴³

In the past both wastewater and storm water were collected in combined storm/sanitary sewers. The current practice involves collection in separate systems. Figure 21 shows the trunk sewer disposal system for the Hamilton-Wentworth region. Although this system is basically a sanitary sewer there still exists a section which consists of a combined sanitary and storm sewer. Figure 22 illustrates the water distribution system which is totally separated from the sewer system.¹⁴⁴

The residents of Hamilton Beach do not have to rely on wells for water since they are serviced by the Regional system. There is also a system of storm water sewers on Hamilton Beach which collects storm water and diverts it into the Bay. This area is not serviced by sanitary sewers. As stated in the preceeding chapter, residents must rely on private sewage systems (septic tanks or soil absorption/cesspool systems). The possibility of using combined sanitary/storm water sewers must be ruled out

because the water flows directly into Hamilton Bay without being treated. What are the alternatives to private sewage collection systems ? There are basically three types of sewage collection systems. All rely on a network of pipes to collect and transport sewage.¹⁴⁵ These systems are: gravity sewers; pressure sewers and vacuum sewers.

Gravity sewers are the most common and have been used for many years. The other two systems have been developed recently and employ more advanced technology. These two methods can be implemented when conditions make it too expensive or too technically difficult to install gravity sewers. Selection of a sewer system is dependant on site conditions and available budget. Appendix H describes how the construction of sanitary sewers are financed in the Hamilton-Wentworth Region. In developing a public sewage system, detailed analysis must include information on the following:

- "- population served (25 year projection)
- volume of sewage per capita,
- type of system (domestic, commercial, industrial),
- rate of sewer infiltration,
- soil condition or type,
- total land area served (25 year projection)
- receiving sewage system capacity,
- proximity to water supply systems."¹⁴⁶

Sewers must be designed so that they will be able to handle long term needs; a minimum of 25 years is usually used although some have been planned to accomodate needs over 50 years.

The usual sequence of events involves the construction of sewers for proposed developments some time in the future. In this case though, we are talking about the installation of sewers in a developed neighbourhood. It is wise then to keep in mind that the total cost for sewer construction will also include disturbance of the local environment and temporary inconvenience to the residents and commuters who drive on Beach Blvd.

A brief description of these three systems will be presented emphasizing their advantages and disadvantages and their application on Hamilton Beach.

Gravity Sewers

The use of sanitary sewers is the conventional method for collecting sanitary waste. Household plumbing is connected to a sewage treatment plant through a network of pipes laid in deep trenches at specified slopes. Under normal conditions of topography and soil composition, this form of collection is the most economical. Gravity sewers are classified according to the type of waste they carry. They can be either combined sewers which collect both sanitary waste and storm water, or separate sewers which collect sanitary/industrial waste and storm water in separate pipes. The sanitary waste is transported to a treatment plant whereas the storm water can be diverted to a river, lake or any body of water. The recommended and up-to-date practice is to use separate sewers.

Wasterwater is propelled through the inclined pipes by the force of gravity. The collection network of pipe sections contains manholes at specified intervals for inspection and cleaning. Pipes must be laid at a slope that will ensure that sewage will flow at a self-scouring velocity of .6 m./sec (2 ft./sec/).¹⁴⁷ Usually a 1% grade will ensure the self-scouring velocity but this may depend on the size and type of the sewer pipe.

Sewer pipes can be made of the following materials: plastic; concrete; vitrified clay; asbestos cement; cast iron; corrugated metal; and newly developed lightweight fiberglass reinforced mortar plastic pipe.¹⁴⁸ Different pipe materials offer different properties so there is no single material best for all situations; for any particular job there may be one type which stands out above others.¹⁴⁹ Sewer pipes should be no less than eight inches in diameter¹⁵⁰ and can be as wide as 36 inches.¹⁵¹ Joints between sewer pipes are designed to minimize infiltration and prevent roots from intruding.

The depth at which sewers are laid depends on the local conditions. The cost of sewer construction increases proportionally with the depth of trench and other factors such as the level of the water table, the nature of the soil, the need for protective shoring of trenches, the location of underground utilities, and other conditions.¹⁵² Specifications require that manholes be located no more than 400 feet apart and are usually found at the end of sewer lines; at the junction of lines; where pipes change in diameter.¹⁵³ Specific distances vary with the size of pipe used.

size of pipe used.

The total network pattern takes a tree-like formation or a natural tributary watercourse arrangement so that the movement of sewage is continuous and the flow increases into progressively larger conduits. Sewers are usually laid in street rights-of-way along the center line; if they can be placed under unpaved sections the cost of repairs and maintenance will be reduced.

A schematic representation of a sewer system is shown in Figure 23. To accommodate for interference of flow by a rise in the topography, pumping stations and force mains can be installed to lift the sewage into another conduit at a level where gravity flow can continue. Force mains are pipes that carry sewage against the flow of gravity and under pressure; they are usually used to transport sewage at minimal slopes over long distances. They are found in conjunction with pumping stations; this makes them quite expensive due to the capital investment and operating and maintenance costs of the pumping station.¹⁵⁴

Hamilton Beach is a most unique neighbourhood. There are a few considerations in this area which influence the cost of constructing sanitary sewers. Briefly these are: a high groundwater level; the fact that this area is a long and narrow strip of land; it is basically made of sand; the topography is generally flat and there is a slight rise in the land in the direction of the Regional Sewage Treatment plant on Woodward ave.

About ten years ago a study was conducted on the feasibility of constructing sanitary sewers on Hamilton Beach. According to the Regional Engineering department this system would have consisted of a network of gravity sewers with three or four lift stations

and a force main connecting it with the Woodward plant.¹⁵⁵ The cost was estimated to be \$6 million in 1972 dollars; in today's dollars this figure would be approximately \$10 million. So although it is technically possible to construct gravity sewers on Hamilton Beach, the cost does not make it feasible.

There is yet another possibility of cutting down the cost of construction of sewers. The Hamilton Harbour Commissioners have planned an industrial park on the Bay side of Hamilton Beach. In the report on the East Port Industrial Park, plans show that a force main will be constructed from the Regional Sewerage Treatment plant and connect to a gravity sewer system in the Industrial Park.¹⁵⁶ This system will service the whole area shown on the map in Figure 24; this represents about 6,000 employees. According to the Region, the force main would have the capacity to take on sewage from Hamilton Beach in addition to that coming from the Industrial Park. A force main for Hamilton Beach is then available and need not be constructed specifically for the residents of this area. The cost of this force main is estimated at \$600,000.¹⁵⁷ however this does not significantly reduce the total figure. The fact remains that Hamilton Beach will have to be serviced eventually even in a recreational or mixed land use scheme and connection to the Industrial Park system remains a promising alternative.

The advantage of using gravity sewers is that it is fairly simple in technology. Special training of personnel is not required. The disadvantage is that the cost of constructing gravity sewers on Hamilton Beach is very high.

Alternatives to Gravity Sewers

The cost of installing gravity sewers is expensive especially with today's economic situation. New technology has been developed in response to the needs in rural areas and because of the high cost of sewer construction. Now there are alternatives to the conventional public sewerage system, some newer than others. Johnson suggests that the key to success for selecting an alternative system, is to select one that is cost effective and is most appropriate to the particular site conditions, ensuring that it is properly installed and most importantly that proper maintenance is conducted.¹⁵⁸ The two main alternatives described here are the pressure sewer system and the vacuum sewer system.

Pressure Sewers

Pressure sewers are a viable alternative to gravity sewers especially in areas having high groundwater level or where homes are scattered over a large area. This system is similar to a force main except in this case the whole network of pipes is under low pressure (241 kPa or 35 psi).¹⁵⁹ Pipes are much smaller in diameter, two to six inches, and are usually made of plastic or PVC. The main advantage of this system lies in the fact that the pipes can be laid just below the frost line and are parallel to the ground surface. As a result this system is quite independant of topography.

Pressure in the system is supplied by pumps located on the

resident's property. There are two basic types of pressure sewers which use onlot pumping units as the heart of the system:

1. Grinder Pump (GP) system. A grinder pump is a pump situated within a small storage tank. Grinder pumps can be installed in a basement or in between lots, so that neighbouring residences can share the unit. Effluent from the house is ground up and then pumped, untreated, into small diameter pipes. The components of a GP system include:

" a holding basin with sufficient volume to accumulate enough liquid for a one to two minute GP cycle operation; grinder pump, with a combination grinding and macerating unit attached to the bottom of the pump; discharge piping, including check and discharge shutoff valves; control circuits and components for operating the units; an alarm system for indicating to the homeowner that a high level is exceeded in the storage tank; and onlot piping between the pump tank unit and the mainline in the street." ¹⁶⁰

The GP system was developed by the Environment/One Corporation. In tests conducted on twelve single house units in Albany, New York, grinder pumps averaged 2.6 operations per person per day; each operation lasted about 60 seconds. ¹⁶¹ The grinding operation begins when a predetermined amount of sewage is collected in the tank.

Pressure systems can transport effluent directly to a treatment plant or can discharge it to a conventional gravity sewer.

2. STEP system. The Septic Tank Effluent Pumping (STEP) system combines an existing or new septic tank with pressure sewers. ¹⁶² Household waste is treated in a conventional septic

tank and the effluent is pumped into the pressure sewers. The components of the STEP system include:

" the interceptor tank for removing as much grease and solids as possible; the pumping chamber, which houses the effluent pump; the effluent pump itself; discharge piping, including check and discharge shutoff valves; control systems for turning the pumps on and off; high-level alarms; overflow device; and service lines." ¹⁶³

Effluent pumped from the STEP system can be discharged into a conventional sewer or directly to a treatment plant. Figures 25 and 26 illustrate the GP and the STEP systems. Both systems are powered by electricity.

The chief advantage of the pressure system is that it is not dependant on gravity flow therefore pipes can follow the countour of the ground surface.

Pipes are usually laid in trenches between two and four feet deep. ¹⁶⁴ Another advantage of this system is that there is no groundwater infiltration. Conventional sewers are susceptible to cracks along the pipes and leakages in joints after many years. With small diameter plastic pipes, joints are made watertight in a number of ways. ¹⁶⁵ Because of this situation, there is lower flow through the pipes although the sewage composition is stronger. ¹⁶⁶ Air relief valves are installed at every 122 - 183 m. (400-600 ft.) for cleaning and maintenance. ¹⁶⁷

Grinder pumps are expensive and as suggested in the literature, if the cost of excavation is not significantly lower than for gravity sewers, the decision of using pressure sewers should be reconsidered.

Estimated cost of grinder pump unit, including a prorated share for the main sewer system is about \$2,500 for a single home unit. Figure 27 compares cost figures for the installation of 38 GP units versus 38 STEP systems.¹⁶⁸ Results show that for a GP unit, the total monthly cost is \$32.08 whereas for the STEP unit the cost is \$22.29 . These figures are not up to date but do demonstrate that a STEP system is more economical than a GP system.

Hamilton Beach with its high water table, its relative flatness, its sandy soil and its developed state, would lend itself quite well to the application of pressure sewers. A more detailed investigation on the specifics of a tailored system for Hamilton Beach and cost figures is required. Since houses on the Beach are already serviced by septic tanks, installation of the STEP system would be the recommended method.

The cost of installing GP systems versus STEP systems on Hamilton Beach cannot be estimated at this time without further analysis. This is a most interesting alternative to gravity sewers even though it is quite mechanized and does require basic maintenance on the part of the homeowner and training of personnel to perform checks and repairs.

Vacuum Sewers

The vacuum method for collecting wastewater is an advanced one in which movement is produced by air pressure. "Vacuum sewers carry plugs of wastewater (separated by air gaps) at high velocities through small diameter pipes, utilizing a pressure differential of about one half atmosphere which is

created by partially evacuating the pipe network."¹⁶⁹ This system shares the advantage with pressure sewers of utilizing smaller pipes (usually made of PVC) requiring less excavation and of being independant of topography.

Vacuum systems are quite flexible and can be designed to suit the needs of a particular area to be serviced. In this discussion general information is presented on the "On-Line" system which is used when conventional plumbing fixtures are connected to a vacuum main.

The vacuum sewage system was invented by a Swedish engineer in 1969. In Canada this system is distributed by Vacusan Systems Limited.¹⁷⁰ The On-Line sewage system was introduced in 1976 and was first operated in Canada in Surrey, British Columbia in May 1979 (see Figure 28). This area is situated on the floodplain of the Fraser River. It is flat and has a high water table. The area suffered from contamination from septic tanks. Conventional sewers could not be installed because it was technically difficult and economically unfeasible. The On-Line system was installed and proved to be successful.¹⁷¹

The vacuum On-Line system is an economical and technical alternative for areas having one or more of the following problems:¹⁷² high water table; flat land; low density; scattered development; marginal land; rocky terrain; adverse grade conditions.

The vacuum On-Line system basically consists of an interface unit which collects sewage from homes or other sources; a piping network which transports sewage and distributes the vacuum; and a collecting station where the vacuum is created and where

sewage is both received and discharged. The sewage collected can either be diverted to a conventional sewer system or be collected and trucked away. Figures 29, 30 and 31 describe in more detail these three major components. Figure 32 describes the way in which the gravity system in a house connects to the interface unit.

The maximum length of a vacuum main is 2,000 meters and it has the capacity to transport effluent of 50 - 100 homes.¹⁷³ Here are a few of the features offered by the vacuum On-Line system:

- Installation is independent of topography. Shallow trenching greatly reduces excavation costs.
- Pipes used are much smaller in diameter. Vacuum main start at 2½ inches and a six inch vacuum main can carry sewage from at least 100 homes.
- Vertical lifts within the pipe are possible.
- Vacuum sewers can be installed beside water mains in the same trench because there is no possibility for seepage from vacuum mains.
- Inspection pipes about three to four inches in diameter are brought to the surface and are far less expensive than manholes.
- All electrical hook-ups are found in the collecting station where vacuum pumps are located.
- Vacuum pipes can be easily re-routed around unforeseen ground obstructions.
- Disruption to residents is minimal during the installation of the system.
- Interface units isolate each home or building from the main thus preventing backflow from the main to the house or from house to house in the case of a blockage.

Figure 33 contains general and up-to-date information on the installation of the vacuum On-Line system. This is also

an interesting alternative for Hamilton Beach. The physical restraints of that area warrant a more detailed analysis on how the vacuum On-Line system can be implemented. With the information collected to date this seems to be far more economical than installing a gravity sewer.

Summary

Although Hamilton Beach is serviced by watermains, no municipal sewage collection system exists in that area. Residents must rely on private sewage systems, more specifically septic tanks, and soil absorption/cesspool systems. Certain physical conditions such as a high water table, the sandy composition of the soil, the relative flatness of the land, and the fact that it is a long stretch of land, are responsible for the enormous cost of installing gravity sewers and a force main connecting this area to the Regional treatment plant.

Three alternatives for municipal sewage collection were briefly discussed. Construction of conventional gravity sewers would be quite an expensive proposition but a reduction in cost can be achieved if the gravity sewers can be linked to the proposed sewerage system for the East Port Industrial Park. This would eliminate the cost of constructing a force main from the treatment plant to Hamilton Beach.

Two more technically advanced methods of sewage collection were briefly described. Both the pressure sewer system and the vacuum On-Line system have distinct advantages over the gravity

system. They can be adapted to Hamilton Beach given its physical conditions. They are alternatives worth looking into; both systems could possibly link up to the Industrial Park sewerage system. Perhaps a cost analysis would shed more light on which system would be most economical to use in this case. The fact remains that Hamilton Beach will have to be serviced with sewage collection in the future. Alternatives to gravity sewers exist and would be appropriate for an area such as this.

ESTABLISHING MIXED LAND USE ON HAMILTON BEACH

Hamilton Beach has an area of 2345 acres of land. The sandstrip is composed of two major land uses. The largest percent (43.6%) of this area is classified as open space and 33% is classified as residential land. At this time the Beach is predominantly a residential area with the majority of open space being vacant land. The other 23.4% is composed of institutional, retail outlets and services, transportation/communications, utilities and parking uses. (see Table 23) The residential, commercial and institutional uses of the area are threatened by the Acquisition Programme and the future plans to redevelop Hamilton Beach as parkland.

A decision to redevelop Hamilton Beach has been made without a complete evaluation of the present residential use. All the problems which threaten the neighbourhood need to be examined. The problems must be analyzed to determine if they are severe enough to condemn the entire neighbourhood. An evaluation of the residential use of Hamilton Beach must go beyond the problems and examine the positive characteristics of this community. It is important to present evidence supporting the preservation of the neighbourhood just as evidence has been presented to support redevelopment.

A complete evaluation of the future recreational use of Hamilton Beach also needs to be presented. The disadvantages of redevelopment as well as the advantages need to be determined. The parkland plans should be questioned just as the City and Region have questioned the viability of the neighbourhood.

Once a detailed evaluation of the recreational and residential use of the area have been made it is essential to examine a compromise between these two major land uses. It is necessary to determine the compatibility of homes and parkland on Hamilton Beach. The trend towards mixed use planning and the advantages of a mixed use solution need to be established.

The Residential Use Of Hamilton Beach

Hamilton Beach has 77.2 acres which are classified residential. A number of problems threaten the residential use of this area. Pollution and flooding concerns and the lack of sewers present the greatest threat to the existing neighbourhood. Beyond these three concerns are the problems of heavy traffic, the closure of the elementary school and depreciating housing values which affect the residential area. All of these concerns have been used as arguments to justify redeveloping the neighbourhood for parkland. The severity of the problems and the strength of the arguments need to be determined. The positive characteristics of the neighbourhood also need to be determined along with the negative characteristics. The positive qualities of the community must be examined if a fair evaluation of the residential environment is to be obtained.

The Negative Characteristics of Hamilton Beach

Heavy traffic, the closure of the elementary school and a

depreciating housing stock are three concerns yet to be discussed.

Heavy Traffic on Beach Boulevard

Beach Blvd forms the spine of the Hamilton Beach community and it is the major route for local traffic going through the area. The volume of traffic using the road is high. The boulevard has been carrying over 10,000 cars daily since the mid 1960's.¹⁷⁴ Beach Blvd is also the only direct alternative route to the Q.E.W. when the Skyway Bridge is closed due to an accident or poor weather conditions. The high volume of traffic that this road carries increases the level of noise and air pollution in the neighbourhood. The volume of traffic often creates an inconvenience for residents trying to reach or leave their homes by car. It also increases the hazards of a traffic accident.

The traffic problems experienced by the neighbourhood are serious at this time, however, action is being taken to reduce the high volume of traffic. The Ministry of Transportation and Communications (MTC) has approved Stage One of their plans to expand the Skyway Bridge. A new four lane arterial road will be constructed from Burlington Street in Hamilton to Highway 2 in Burlington. The road will be placed on the bayside of the Beach on land fill. The proposed development will begin in 1982 and is expected to be complete by the end of 1983. This free flowing arterial road should divert most through traffic away from the neighbourhood. The MTC estimates that the volume of traffic will be reduced from 10,000 cars to 3,000 cars a

day.¹⁷⁵ The high volume of traffic on Beach Blvd is no longer sufficient evidence in support of the Acquisition Programme.

The Closure of Bell Cairn Memorial School

Declining enrollment and the eventual closure of Bell Cairn School is another problem which has affected the Hamilton Beach Community. (see Table 24) Eighty-eight children attended the school until its closure in June of 1981. These children must now be bused to schools outside their neighbourhood.

The closure of the elementary school may be seen as a problem by residents with young children, however, this problem is not unique to the residents of this area alone. All across the country declining enrollments have closed elementary schools. In the City of Hamilton public school enrollments declined 26% between 1969 and 1979. Since 1975, 10 elementary schools have closed in the City.¹⁷⁶ Such statistics indicate that Hamilton Beach is not the only neighbourhood to experience a school closure. The Board of Education for the City found that many schools in the older residential areas of the City were emptying as a result of the age structure of the population. The population of Hamilton Beach is not child oriented but is composed of a large portion of young and mature adults. The age structure reveals that there is no longer a great need for an elementary school in the neighbourhood. The negative implications of the school closure can be further minimized by the attitude of many of the residents. In 1981 a survey of 225 neighbourhood people

indicated that only 8% of the residents view the closure of the school as the major problem confronting their area.¹⁷⁷ The closure of Bell Cairn School can even be seen as an advantage. The quality of education at this school had deteriorated to a point where one teacher was teaching as many as three grades. Now that the school is closed the children attend a larger school with more facilities and a better equipped teaching staff. It is most likely that the 88 students are now receiving a better education.

In Project 36, the Conservation Authority used declining enrollments at Bell Cairn School as another factor in support of the Acquisition Programme. This factor lends little support to the programme given declining enrollments across the country, the residents' attitudes and the quality of education at the school.

Housing Quality

The housing quality on Hamilton Beach is the final topic of concern. The appearance, the age and the seasonal nature of the homes in the neighbourhood have been criticized. Several studies have noted that the quality of the housing stock on Hamilton Beach is poor. The Halton-Wentworth Waterfront Study states that the homes are of a depreciating quality. The study recommends that the homes be removed from the Beach.¹⁷⁸ The 1969 Official Plan for the Beach Strip maintains that 50% of the homes are in poor condition while 50% are in fair condition.¹⁷⁹

In contrast to the above report a recent windshield survey conducted by this study team found that the housing conditions on Hamilton Beach are not as bad as they have been portrayed, if the age of the homes is considered as a separate factor. The survey results show that 74.4% of the homes fall in the good, good/fair and fair categories. Only 25.3% of the homes range from the fair/poor to the bad category. (see Table 25) The homes in poor condition can be explained by the uncertainty of future plans for Hamilton Beach. The residents of Hamilton Beach have no guarantee of when their homes will be purchased by the Conservation Authority or if all the homes will be purchased. As a result, residents are reluctant to improve their homes. They do not want to spend money on homes that might eventually be demolished. People fear they will not see a return on their investments if they are forced to sell to the Conservation Authority. There are people who would like to upgrade their homes but find it difficult to obtain building permits from the City. (see Appendix G)

The age of the homes can be considered as a separate factor in evaluating the housing stock on Hamilton Beach. The houses along Beach Blvd are old. Seventy-one percent of the homes were built before 1930 while only 2.3% of the homes are less than twenty years old. (see Table 26) Because the homes are old many are in need of some repair.

The problems of older housing are not unique to Hamilton Beach. Ontario's Housing Minister Claude Bennett has stated that Ontario's housing stock is aging and is in need of some

repair or renovation.¹⁸⁰ The Ontario government is actively involved in encouraging rehabilitation and community renewal programmes in order to alleviate this problem. With 68% of its housing stock over twenty years old, Hamilton-Wentworth is also interested in the rehabilitation of older homes. A recent housing study conducted by the Region recommends that revitalization programmes be encouraged in older residential areas and that area municipalities make full use of existing rehabilitation assistance programmes.¹⁸¹

A final problem associated with the housing stock on Hamilton Beach is the seasonal nature of many of the homes. In Project 36, the Region claims that the houses are intended mainly as summer cottages. The 1976 regional housing study also indicates that the majority of homes on the Beach are converted cottages and they are unsuitable as permanent accommodation.¹⁸²

The general statement made by both of these reports are misleading. Approximately 50% of the homes were built prior to 1920 when the area was primarily a cottage area. After 1920 Hamilton Beach began a transition from a resort into a permanent residential community. Most homes built after 1920 were in response to a housing shortage in the City of Hamilton, and as a result were intended for permanent accommodation. It is unfair to imply that most of the homes are intended only as summer dwellings when at least 50% are permanent dwellings. (see Table 26) It is also unfair to imply that converted cottages are unsuitable as year round residences. In a study of the

Toronto Island Neighbourhood, the Toronto Medical Health Officer stated that winterized cottages on the Islands were acceptable to live in year round.¹⁸³ This study found that few of the cottages were not worth saving. The Town of Grimsby came to a similar conclusion with respect to the Victorian cottages found on Grimsby Beach. The town initiated a Neighbourhood Improvement Programme in this neighbourhood to rehabilitate the original cottages which are now used as year round residences. At least two local governments have established that converted cottages built around the same period as those on Hamilton Beach, are worth saving. Why are the cottages in this neighbourhood different from those on Toronto Island and Grimsby Beach ?

There is little evidence to justify the removal of half the winterized houses on Hamilton Beach. The homes on Hamilton Beach are old but much of the Region's housing stock is old and in need of some repair. There are rehabilitation programmes which could be implemented in this area to encourage residents to upgrade their homes.

The Positive Characteristics of Hamilton Beach

It is essential to examine the positive characteristics of the Hamilton Beach neighbourhood as well as the negative characteristics. The strong points must not be overlooked when determining the area's future just as concerns cannot be ignored.

A Long History

One of the unique qualities of this residential area is its long and colourful history.

This area provides an important link with Hamilton's past. Hamilton Beach was the first area in Hamilton to be discovered, for as early as 1669 the sandstrip was sighted by La Salle.¹⁸⁴ It wasn't until 1794, however, that the first building was erected on Hamilton Beach and named the King's Head Inn. The Inn was primarily used for military purposes as the Beach was a vital link in the military road between the new centre of Niagara-On-The-Lake and York. The Beach was set aside as a military reserve during the 1790's and played a role in the War of 1812. After 1812, Burlington Beach as it was then called, experienced a minor boom in trade and commerce as well as its settlement and overall development. In 1817, the residents of the area petitioned the government for a deeper and longer opening in the sand bar to further encourage trade. By 1830 a navigable canal between Burlington Bay and Lake Ontario was completed. This cut in the sand strip was perhaps the main factor which established Hamilton as a major social and commercial center. In 1850, the major activities on Burlington Beach began a transition from trade and commerce to tourism.¹⁸⁵ Perhaps the most significant period in the area's history was between 1875 and 1920 when the Beach was a well known summer resort and cottage area. The sand strip was lined with beautiful summer homes occupied by some of Hamilton's most prominent citizens during this time. Along with summer homes

there were several hotels and the luxurious resort the Ocean House.¹⁸⁶ During these years one could stroll along the wooden promenade that ran along the Beach and view the beauty of the Bay, yachts on the water, and the steamboats which made daily journeys to Toronto. One could attend the amusement park or the Royal Hamilton Yacht Club where large regattas, other yachting events, dances and moonlight cruises were held. Tourists and residents could engage in such activities as fishing, hunting swimming and picnicking. The fashionable summer suburb is well remembered by many and is considered to have played an important role in the history of Hamilton.

Many of the existing homes on Hamilton Beach are reminders of these "good old days". Eleven percent of the homes were built before 1900 and some date as far back as 1870. Fifty-one percent of the homes were built prior to 1920 during the years when the area was a popular summer resort. (see Table 26) These homes possess valuable architectural elements such as gingerbread and the verandahs that are now rapidly disappearing. The parkland plans threaten to remove homes which are reminders of a colourful period in the history of Hamilton.

A Well Established Residential Area

Hamilton Beach has a long history as a residential area and it has developed into a well established community. At first the area was primarily a summer suburb but as early as 1893 there were 150 people living on the Beach year round. In 1900 there were over 200 permanent residents who fished, farmed and

operated the resort facilities.¹⁸⁷ After World War I the number of permanent residents grew rapidly as cottages were winterized and new homes constructed in response to a housing shortage in the city of Hamilton. In 1936, there were 1,116 permanent residents on the Beach while the number grew to 3,327 by 1956.¹⁸⁸

Today there are approximately 1,500 residents living on Hamilton Beach. The neighbourhood has some families that have lived in the area for generations. A recent survey revealed that 20% of those people surveyed have lived in the area for over 36 years. Other families have resided on the Beach for a relatively long period of time. Fifty-one percent surveyed had lived in the neighbourhood for over 16 years or more.¹⁸⁹ The neighbourhood is a stable area with few movers. A smaller portion of the neighbourhood's population (38.9%) are classified as movers compared to the Hamilton average (47%).¹⁹⁰ All of these statistics indicate that many of the Beach residents have established their roots in the neighbourhood. As a result, a survey taken in the summer of 1981 revealed that 81% of those polled wish to remain on the Beach for the next ten years.¹⁹¹ In 1980, a survey conducted by Sheila Copps (the provincial member of parliament for this area) revealed a similar result. This survey showed that 87% of the residents would like to stay in their neighbourhood.¹⁹² It is unfortunate that the parkland plans will eventually disrupt this well established community and force the residents to relocate.

A Sense of Community on Hamilton Beach

A community atmosphere has developed on Hamilton Beach over

the years. There is a special feeling for this place, a pride in living in the neighbourhood and a sense of attachment to the area felt by many of the residents.

The survey conducted in the summer of 1981 revealed that 70% of the people believe that there is a strong sense of community on Hamilton Beach. Comments made during the survey indicate many of the residents' feelings for their community. Residents frequently made remarks such as: "I wouldn't want to move anywhere else", "I love it here", "It is a good place to live", "It is a nice area on the water", "There is a close knit community along the Beach", "Something is special about this area", "It is an underated area, and it is a unique area".¹⁹³

Hamilton Beach is a resourceful community with the Hamilton Beach Preservation Committee representing the welfare of the neighbourhood people. This community organization is determined to see its community preserved. A large percentage of the neighbourhood support the committee's viewpoints and do not approve of the Acquisition Programme. Survey results show that 94% of those polled would like to see their community upgraded and preserved. In contrast only 15.5% of the residents approve of the proposals to redevelop their neighbourhood for open space.¹⁹⁴

Hamilton Beach is a close knit neighbourhood with community spirit. Many of the residents are committed to seeing their community preserved rather than redeveloped for recreational purposes.

Neighbourhood Services and Facilities

Hamilton Beach Neighbourhood has most urban facilities and services.

The area receives municipal services such as regular snow removal and weekly garbage collection. The neighbourhood is serviced by public transportation with two local bus routes passing through the Beach. The streets and sidewalks are maintained by the City and are in relatively good condition. The City maintains four parks in the neighbourhood. The Arden Rearlands, Canal Park, the Kinsmen Recreation Area and the Skyway Playground provide the neighbourhood population of 1,512 with 2.68 acres of parkland.¹⁹⁵ City standards require only 1.24 acres of recreation space per 1,000 population. There are few lower city neighbourhoods that meet this requirement and have as much parkland as Hamilton Beach.

Besides adequate services, the neighbourhood has a number of local stores and other commercial services directly available to residents. The day-to-day necessities can be purchased at one of the three variety stores. The neighbourhood also has three snack bars and three gas stations. The Dynes Tavern is a spot for the neighbourhood people to eat out and it does provide entertainment. Other commercial activities include: Diamond T.V. sales and Service, Skyway Canvas, Skyway Lawn Equipment Beach Marine Sales and Rentals, Green Gables Antiques and the Beach Motel.

Hamilton Beach has several community facilities located along Beach Boulevard. The neighbourhood has three churches named St. Andrew-on-the-Lake, the Church of the Little Flower

and the Beach Gospel Chapel. The Burlington Beach Fireman's Association Clubhouse provides the community with a meeting place and Bell Cairn Memorial School provides another significant community facility. Although the school is presently empty it does offer the neighbourhood a potential resource. In the U.S. empty school buildings have been recycled into recreation centers, day care centers, libraries, art galleries, theaters, old age homes, offices, shops and apartments.¹⁹⁶ In addition to the above community buildings, the Beach has three residential care facilities which provide the mentally handicapped, the elderly and hospital out-patients with accomodations. Despite the available services and facilities on Hamilton Beach, the area is still criticized for being poorly serviced.

A Convenient Location

Another positive characteristic of this neighbourhood is its convenient location. Those services and facilities which are not found in the neighbourhood are readily accessible by car or bus.

This residential area is within convenient proximity to places of employment. Major places of work such as Stelco and Dofasco are within minutes of the neighbourhood. The Beach is located close to a number of shopping centers. The Center Mall, Eastgate Square, Jackson Square and other downtown stores are convenient. Sources of culture and entertainment such as the public library, the art gallery, Hamilton Place and movie theaters are all readily accessible to the area. Confederation Park, a

major recreational resource for the Region is adjacent to the neighbourhood. Four hospitals are within 5 - 20 minutes of this neighbourhood. All major social services are located within 7 kilometres and can be easily reached. The residents of Hamilton Beach have the advantage of living close to all major urban resources.

Research has shown that the location of a neighbourhood can be an important factor in determining the residents' satisfaction with their living environment. A Toronto study found that people living near the downtown area in single family dwellings showed the greatest multi-dimensional satisfaction in terms of their residential context. The research revealed that proximity to downtown sources of employment, low cost public transit and a variety of commercial and institutional services, provides for a living environment which is more efficient and supportive than that found in connection with better homes in peripheral areas. According to this study people in such locations do not aspire to live elsewhere and relocation to peripheral areas would not substitute given their values and priorities.¹⁹⁷ The conclusions drawn from this research can be applied to Hamilton Beach. The neighbourhood is close to downtown and is predominantly comprised of single family dwellings. It is in convenient proximity to places of work, commerce, culture, recreation, health care and social services. In a recent survey, Beach residents often commented on the advantage of their location and the majority surveyed expressed a desire to remain in this area.¹⁹⁸ It is unlikely that relocation to

another part of the City would provide a substitute for the present residential environment of these people, yet the Acquisition Programme threatens to eventually relocate all residents.

A Low Density Neighbourhood.

Hamilton Beach has the advantage of being a low density environment with an abundant amount of open space. The neighbourhood has a low population density with only 19.75 persons per acre. Such a low density is seldom associated with inner-city neighbourhoods. There are few neighbourhoods in the city of Hamilton with such a low population density. The houses, institutional and commercial buildings are generally well spaced with 25 units per acre. The neighbourhood also has a low gross residential density of 5 dwelling units per acre.¹⁹⁹ This residential area has a large amount of private and public outdoor space. One hundred acres of Hamilton Beach are classified as open space. (see Table 23) The low density and large amounts of open space create a spacious environment and an image of country living. In a recent survey, Beach residents frequently commented on their low density environment and its advantages. The following comments were made with reference to the density: "It is like living in the country yet close to the city", "It has a nice rural setting", "The Beach is a roomy and unique area", "it is a nice quiet area where the houses are well spaced", "I enjoy the privacy". "It is a safe neighbourhood", "It is a good place to raise children."²⁰⁰

All of these comments indicate that Hamilton Beach has many advantages associated with its low residential density.

Not only does Hamilton Beach have a country-like atmosphere, but it has many other advantages associated with low density environments and the advantages of being an inner city neighbourhood. It is not surprising that that many residents are reluctant to leave such a residential area.

The Aesthetic Features of Hamilton Beach

There are several features which make Hamilton Beach aesthetically attractive.

This neighbourhood is diverse. It is unlike modern subdivisions which are now being criticized for their monotony and uniformity.²⁰¹ This residential area possesses pockets of individuality and contrast. There is variety in architecture, colour, setback, and orientation of the homes. The architecture varies so that each home is an individual. The large Victorian summer home, the small post war bungalow and the small cottage are among the styles found in the neighbourhood. This is in contrast to most of Hamilton which is characterized by row after row of mass produced housing.²⁰² There is also wide variation in the age of the homes, some being built as early as 1870 and others being built as recently as 1970. (see Table 26) As well, there are single family dwellings, duplexes, triplexes and other multiple unit dwellings which add to the diversity of this area and create choices for people who decide to live in the area. (see Table 29) The wide range in home values attracts

all types of people and contributes to the diverse character of this neighbourhood.

Mature tree lined streets and landscaping creates an attractive setting on Hamilton Beach. The trees mark the neighbourhood's boundaries, establish its character, sound-proof it, cool it and create contrasts of colour and light intensity.²⁰³ Mature tree lined streets shape and provide unity in the setting as well as add quality and vitality to the site.²⁰⁴

The natural setting of the neighbourhood also contributes to its overall appeal. This residential area is situated on Lake Ontario and is blessed with the unique qualities of the waterfront. The waterfront has been associated with feelings of openness, spaciousness and freedom. It has been described as a place for dreaming, a feast for the eyes, a stimulus to the senses.²⁰⁵ The setting offers Beach residents a long vista of sand, scenic views and the cool breezes of the lake.

The people living on Hamilton Beach often commented on the beauty of their neighbourhood and the advantages of living on the waterfront.²⁰⁶ Many of the residents are reluctant to leave the Beach for they value the aesthetic features of the area.

Low Cost Housing On Hamilton Beach

Perhaps one of the greatest advantages that the Hamilton Beach neighbourhood has to offer is its low cost housing. The majority of homes in this neighbourhood are valued between \$15,000 and \$35,000. (see Table 26) In 1980, the average selling

price in the neighbourhood was \$27,410 and was 36% lower than the average selling price for the entire city of Hamilton.²⁰⁷

A number of Beach residents moved to this area because of the low housing cost and many do not want to leave because they feel they could not afford a house elsewhere in the City.

The supply and cost of housing in the Region indicates that Beach residents may have difficulty in finding affordable housing outside their neighbourhood. Over the last five years carrying charges for home ownership have risen considerably. Soaring mortgage rates and rising housing prices have increased carrying costs by 51% since 1976.²⁰⁸ These carrying charges have increased at a rate greater than the average income in the Region. As a result, many households find it difficult to afford adequate housing. The lower income households are particularly affected by these times of rising costs and housing shortages.

The Region's decision to remove a low cost housing area can be questioned given the high cost and low supply of housing in the Region. It is questionable whether Beach residents can afford to leave this area with the high cost of homes, soaring mortgage rates and the low value of homes on Hamilton Beach.

The Housing Supply

Hamilton Beach not only provides affordable home ownership but a supply of single family dwellings. The single family detached dwelling is becoming scarce in the Region while

this type of dwelling continues to be the most preferred by all income groups.²⁰⁹

The 455 dwellings found in this neighbourhood are predominantly owner occupied, single family detached units. Approximately 81% of the dwellings are owner occupied while 83% are single family dwellings. (see Table 28 and 29)

A recent study of the Region's housing supply indicates that all types of dwellings are becoming scarce. Housing construction over the last three years has been lower than actual housing requirements for the Region. The surplus of single family, semi-detached and row houses which accumulated in the 1976 - 1979 period is now being taken up and the vacancy rate in these units has fallen dramatically to a decade low figure. There is also a shortage of rental units. The Region's vacancy rate for rental units is .7%, the lowest it has been in ten years. As well, there is a shortage of government assisted units for families. Many low income families have their names on waiting lists for subsidized housing.²¹⁰ Overall, the housing situation in the Region is poor.

A number of questions arise with respect to the housing situation in the Region and the Acquisition Programme. Given the low supply of all types of dwellings, can the Region afford to remove 455 homes? Will Beach residents be able to find the type and tenure of homes they most desire, elsewhere in the Region? Finally, is it wise to aggravate a housing market which is already tight? These questions indicate that the Acquisition Programme could be creating additional problems rather than

solving problems.

A complete evaluation of the residential environment reveals that the Acquisition Programme is not readily justified. Many of the problems which confront this area are not severe enough to remove the entire neighbourhood. The noise and air pollution levels, the closure of the elementary school and a depreciating housing stock are characteristic of many urban areas and neighbourhoods in the city of Hamilton. Measures of control for the problems of pollution, flooding and the backing up of septic tanks diminish the significance of these concerns. There is evidence that some of these basic concerns will be alleviated in time. New technology offers a number of possibilities in terms of providing the area with sewers. The future plans for twinning the Skyway Bridge should reduce the volume of traffic, and the levels of noise and air pollution this neighbourhood experiences. Housing rehabilitation and neighbourhood improvement programmes offer funding for upgrading the housing stock and improving neighbourhood facilities, services and utilities. The parkland plans can be questioned given the nature of the arguments used to support the redevelopment of Hamilton Beach.

The arguments used to justify the Acquisition Programme are further minimized by an evaluation of the neighbourhood's positive qualities. When the negative characteristics are balanced with the neighbourhood's positive characteristics the arguments in favour of total redevelopment are weakened. An evaluation of the area's strong points reveal that many Beach residents are satisfied with their living environment and desire

to remain on Hamilton Beach. Such an evaluation reveals that this neighbourhood is a unique area and that Beach residents are unlikely to find a substitute for their present residential environment elsewhere in the city of Hamilton. An evaluation of the neighbourhood's assets indicates that the Acquisition Programme is slowly removing a historically significant, viable and attractive residential area.

The Future Recreational Use Of Hamilton Beach

Hamilton Beach has 101.9 acres of land which is classified as open space. Much of this land has been acquired through the Acquisition Programme. The remaining 772 acres will eventually be acquired for the future recreational use of this area.

The recreational use of Hamilton Beach needs to be questioned just as the residential use of this area has been questioned. There are arguments to support the recreational use of the Beach as well as arguments used to discourage residential use. The need for an additional waterfront access location and regional recreation space as well as the recreational potential of the area have also been used to justify the Acquisition Programme. The strength of these three arguments needs to be determined.

The Need For Access To The Waterfront

It is widely accepted that there is a need for public access to the waterfront. The Great Lakes Shore Management Guide states that public access to the shore is limited on the Great

Lakes. The guide points out that residential strip development along the shore has deprived regional populations of the much needed public access to the water and water-oriented recreation.²¹¹ In many areas, property owners living on the waterfront have blocked off access points by erecting unauthorized fences. The waterfront has also been cut off by commercial and industrial uses. The Halton-Wentworth Waterfront Study stresses the importance of public access to Lake Ontario and Hamilton Harbour. The study states that the recreational capabilities of the lake and harbour can only be fulfilled if there is increased opportunities to get to the shore.²¹² The Official Plan for the Hamilton-Wentworth Region also recognizes that the shoreline of Lake Ontario is a recreation resource and that access to this resource should be encouraged where possible.²¹³ Project 36, states that the Region's population wants access to the beaches. This report indicates that Hamilton Beach is an ideal access point having a major transportation route running adjacent to this waterfront area.²¹⁴ It is evident that the public should have access to the waterfront, however, it is unnecessary for Hamilton Beach to be redeveloped exclusively for recreation to provide the Region's population with waterfront access. As this time, 21% of the Halton-Wentworth shore is accessible to the public. The Waterfront study indicates that the Hamilton-Dundas section of the waterfront has relatively more public waterfront (28%) than other parts of the Halton-Wentworth area. The waterfront access is mainly located at Cootes Paradise where there is 5 miles of public shore and Confederation Park where there is 2 miles. Along with 12.5 miles of fully

accessible shore, the Region has 7 miles of shore owned by various public or semi-public bodies to which the public has qualified access.²¹⁵ Cemeteries, the unfenced areas around Burlington Canal and the majority of Lakeside areas have this semi-public character. Ontario Hydro owns the sand beach, not the residents of Hamilton Beach. A number of side streets terminate at the water's edge on the Lakeside of the Beach. Strictly speaking, a road which ends at the waterfront constitutes public access. It is not necessary that each public access area become a miniature park.²¹⁶ Technically, the Beach has numerous access locations at the edge of the 279.9 acres of water that surround this sandstrip. The Izaak-Walton League of America and the Sport Fishing Institute of America both recommend at least one access area should be allocated for every 100 acres of lake-water surface.²¹⁷ According to these standards, the Beach already provides sufficient public access to the water. Much of the present amount of accessible waterfront land is located close to Hamilton Beach or includes this area.

The Halton-Wentworth Waterfront Study recommends that the public shore should be increased from 10 to 40% to secure public access in the future. This report suggest that 5 regional parks be located at 6-mile intervals along the waterfront. As well, the study recommends that there should be: 47 street end parks, 13 creek mouth parks, 67,000 feet of promenade and 8150 feet of creek trails, as well as 10 community parks to provide convenient shore access. Given the long list of existing and proposed parks and waterfront access locations, the need for an additional access point on Hamilton Beach seems insignificant.²¹⁸ (see Appendix I)

The present accessibility of Hamilton Beach and numerous existing and proposed access locations minimize the need for the exclusive recreational use of this area.

The Need For Regional Open Space

There is great demand for recreational land and facilities at the regional level. The Ontario Recreation Survey suggests that the demand for recreational opportunities in much of Ontario outstrips the supply. The survey emphasizes the need for additional day-use recreational land and recommends that this type of parkland be increased by 25% in the 1976 - 1991 period. The study found that the majority of day-use needs originate within the Golden Horseshoe. The survey indicates the type of recreation facilities that are in demand. This study found that the five most popular recreational activities among Ontario residents were swimming, fishing, travelling, camping and golfing respectively.²¹⁹ Recreational facilities which cater to these preferences are probably the most needed. The Halton-Wentworth Waterfront Study emphasizes the need for more open space at the regional level. According to this research, increasing leisure time, energy shortages, and a greater distribution of wealth will increase the demand for recreational space. The study claims that in the next 30 years the population in the area will almost double and that this will put heavy pressure on existing open space. The report indicates that there will be greater demand for touring, walking, picnicking, camping, sunbathing, boating, viewing, scenic drives and tourist services.²²⁰ The Hamilton Region Conservation Authority also

stresses the need for additional local recreational land. The agency maintains that there is a lack of well-distributed open space. The 1980 Annual Report reveals that all the Conservation Authority's land and facilities are experiencing an increase in use. Attendance figures for the 10 conservation areas show that 450,000 people visited these areas in 1980 compared to 375,000 in 1979. The report indicates that the Valen's and Christie Conservation areas and Confederation Park were all well used. The first two conservation areas were visited by 237,000 people while 107,000 attended Confederation Park. The Hamilton Region Conservation Authority states that there is little doubt the trend towards the increased use of local recreation areas will continue, especially in view of the everincreasing gasoline costs. Thus, the acquisition of strategically located local open space areas will be an important component of their conservation programme.²²¹

The supply of recreational land and facilities must be determined along with their demand. There are 13,024 acres of public open space in the Hamilton-Wentworth Region. Approximately 1,840 acres are classified as public parkland. Other spaces include municipal properties, the mountain face, Conservation Authority lands, the Royal Botanical Gardens and the Regional Forest. Together these lands comprise 11,164 acres of public open space while the Region has 4,534 acres of private open space. (see Table 30) Conservation Authority lands provide a number of these acres of recreational space as well as a variety of recreational opportunities. Most of the Conservation areas are developed for passive

activities such as walking, nature observation and photography. Some of the areas are developed for intensive recreation as well. There are opportunities for swimming, fishing, picnicking, camping, cross-country skiing, boating, sailing and hiking. (see Figure 34) The 20 Conservation areas combined total 6,090 acres and are primarily used for home-based day outings.²²² The Royal Botanical Gardens provide another open space area of regional significance. The 1,855 acres of woodland and planted areas that surround the Harbour are largely used for nature education and passive recreation. The Regional Forest is another important recreational resource for the Region. The 868 acres of forest supply the Region with additional places to hike and picnic as well as a wildlife management area. The Niagara Escarpment is the last of these four major recreational resources. Bruce Trail offers opportunities for walking, hiking and nature studies. An examination of the present supply of regional open space reveals that there are no deficiencies in the Region as a whole. There are 32 acres of public open space per 1,000 population plus an additional 11 acres of private open space per 1,000 population. (see Table 30) A multitude of sources suggest 10 to 20 acres of recreational land per 1,000 population.²²³ These standards indicate that the problem is not the quantity of open space but the distribution of open space in the Region. Much of the open space is concentrated in Flamborough while local deficiencies of parkland exist in the older areas of the city of Hamilton.

The supply of recreational resources for the city of Hamilton needs to be examined more closely. The City has 3,358 acres of

public open space and 1,274 of these acres are classified as parkland. (see Table 30) The other 2,084 acres of open space include the Royal Botanical Gardens, Hamilton Region Conservation Authority lands, Mountain face, King's Forest Park, Chedoke Golf Course, Redhill Creek and other properties. The City manages 66 parks, 10 district recreation centers, 4 indoor and 4 outdoor arenas, 7 pools, 2 community centers, 7 stadiums, 8 tennis clubs and two public golf courses. The City's Official Plan establishes a minimum of 2.9 hectares of passive and active parkland per 1,000 population as a target. Passive and active open space together provide 3.2 hectares per 1,000 population. Twelve percent of the City's total area is devoted to open space.²²⁴ Generally, ten percent of a municipality should be devoted to recreation.²²⁵ The City's total amount of public open space provides 10.81 acres per 1,000 population. Pearson recommends 10 acres of recreational land per 1,000 population.²²⁶ According to all these standards, the entire City has sufficient parkland. The problem occurs in the lower city neighborhoods which are deficient in parkland and open space. A number of the lower city neighborhoods do not meet the City's standards for open space.

The supply of waterfront land for recreational purposes also needs to be examined in greater detail than that already given. The Hamilton Region Conservation Authority is the main agency involved in recreational projects on the waterfront. The Halton-Wentworth Waterfront Study largely initiated this involvement on behalf of the Conservation Authority. The study found a deficiency in the supply of waterfront parks and access

locations. (see Appendix I) Since the completion of the study, the Conservation Authority has become directly involved in four major waterfront projects: the Fifty Point Conservation Area, the Stoney Creek Waterfront, Confederation Park and the Beach Strip. The Fifty Point Conservation Area comprises 181 acres of land. This area has been open for a number of years for trout fishing, and picnicking. In 1982, the day use beach area will be open to the public and by 1983, a marina should offer dockage for up to 290 boats. Development of camping grounds will follow the completion of the marina. The Stoney Creek Waterfront will be developed for recreation in other locations as well. Cherry Beach will become another waterfront open space area. The natural beach will provide a substantial length of water access. The Fruitland Road area will be developed for residential, tourist, commercial and open space uses. A marina will be located at this access point. The Stoney Creek Waterfront Study recommends an additional 55 acres of community and neighbourhood parkland. The study also suggests that a bicycle and pedestrian path link the various open space areas. Confederation Park is another waterfront open space area of importance. Confederation Park now owned by the Regional Municipality of Hamilton-Wentworth became the responsibility of the Conservation Authority in 1980. This 205 acre park offers many recreational opportunities. (see Figure 34) The Conservation Authority is also researching further attractions. A children's village complex, a wavetek pool and a display of two old warships sunk in 1812 are among the future possibilities for this recreational area.

The Beach strip is another area of future recreational potential according to the Conservation Authority. The Halton-Wentworth Waterfront Study largely initiated the Beach strip Property Acquisition Programme. The Waterfront Study maintains that the Beach area should be reclaimed as a major recreational resource for local, regional and provincial purposes. The study recommends that the homes be removed from the Beach in order to increase the recreational potential. The report suggests that the majority of redeveloped Beach should be landscaped for passive purposes with intensive uses at a few select locations. The intensive uses would include a Tivoli Gardens, a tourist information centre, and camping grounds.²²⁷ As a result of these recommendations, the Conservation Authority has been acquiring homes on the Beach since 1976. Over the next 25 years it hopes to acquire all of the 550 residences to make way for the redevelopment of Hamilton Beach as a lakefront recreation area.

While the demand for recreational land in the Region is great, it is questionable whether the exclusive recreational use of Hamilton Beach is essential to meet these needs. An evaluation of the supply of regional open space reveals that there are no existing deficiencies. There are 43.21 acres of public and private open space per 1,000 population. The city of Hamilton as a whole does not appear to need additional open space. While the lower city neighbourhoods are lacking in open space the need is at the neighbourhood level not the regional level. These neighbourhoods need parkland within a quarter to half mile radius not parkland at some distance. The need for another

waterfront recreation area can be questioned. The Halton-Wentworth Waterfront Study proposes that 1,008 acres of regional park be created within a quarter mile distance of the shore. The study recommends a number of regional parks: Joshua's Creek, Bronte Creek, Sheldon Creek, the Beach (Indian Creek, Burlington Beach, Hamilton Beach, Confederation Park, Redhill Creek), Cootes Paradise/Royal Botanical Gardens and the Fifty Point Conservation Area. The report suggest that the Halton-Wentworth Waterfront should eventually have 2,489 acres of open space. (see Table 31) The need to include Hamilton Beach in this system appears much less pronounced considering that this area only occupies 9.4% of this total proposed system. The need for additional open space in the Beach area can be questioned given the numerous other recreational resources to be further developed close to this neighbourhood. The Fifty Point Conservation Area, the Stoney Creek Waterfront, Confederation Park and Burlington Beach are all in close proximity to Hamilton Beach. All of these factors indicate that there is no absolute need to include Hamilton Beach in the Region's future supply of waterfront open space.

The Recreational Potential of Hamilton Beach

A number of studies comment on the recreational potential of Hamilton Beach, however, this potential can also be questioned. The Halton-Wentworth Waterfront Study states that this unique 6 mile sandbar is a superb walking area with panoramic views.²²⁷ It suggests the Beach has potential as a swimming, boating and fishing area as well. Project 36, maintains that while the

Beach strip is becoming less satisfactory as a place for permanent residential use it offers tremendous potential for recreation. This report claims that this strategically located land is particularly suited for boating, fishing and viewing of the steel plants.²²⁹ The Official Plan for the Regional Municipality of Hamilton-Wentworth states that the predominant function of the lakeshore area should be public open space and water-oriented recreation. It recommends the continued acquisition of properties on Hamilton Beach and the formulation of a master plan for water oriented recreation and open space.²³⁰

A number of factors indicate that this area is not ideally suited for recreation.

The Halton-Waterfront Study states that the noise and air pollution severely limit the recreation potential of Hamilton Beach.²³¹ Project 36 also recognizes these pollution concerns and their negative impact on this area's recreational use.

There has been some research on the effects of outdoor recreation in polluted areas. Exercising in a milieu of high levels of air pollution may contribute to such health problems as chronic respiratory disease, emphysema, and lung cancer.²³² The literature clearly indicates that recreational facilities and activities near heavily travelled roads may expose participants to levels of air pollution considerably higher than the general ambient levels in the same urban area.²³³ The uptake of carbon monoxide increases as the pulse rate, respiration and duration of exposure increases. A more rapid uptake of carbon monoxide under exercise may also indicate a more rapid uptake of other pollutants whose effects may not be reversible. Particulates,

gaseous pollutants and lead may all enter the body faster with exercise. It is possible that vigorous respiration will aid in the cleansing mechanism of the lungs and if exercise is terminated in clean air, heavy breathing will have expelled polluted air. On the other hand, some evidence is available that suggests even short term exposure of certain types of pollutants create long-term health hazards.²³⁴ A few controlled experiments have indicated some of the negative health impact of exercise in polluted air. Studies on the track times of runners in Los Angeles showed poorer times when smog was high.²³⁵ One study showed that brief outdoor exercise in Los Angeles type smog induced physiological responses not present when a person exercised in clean air or when at rest in the smog.²³⁶ A clinical study on mice revealed that mice subject to ozone under concentrations of 1 ppm, experienced no harmful effect. But when the mice were subject to 15 minutes of treadmill exercise per hour, fatalities occurred within five or six hours.²³⁷ A report on an insidious air pollution episode in New Jersey showed that persons most affected were those exercising outdoors. Members of a local football team suffered headaches, nausea and vomiting.²³⁸ In an article entitled "Roadside Air Pollution Hazards and Recreational Land Use Planning", Everett states that a person desiring exercise and outdoor recreation is faced with the probabilistic cost of respiratory and other diseases (with increase with age) if they pursue recreation in polluted areas. This article proposes air pollution indices in standards for recreational land use planning. The author recommends that planners should stress the promotion of overall

health in recreational land use planning rather than merely stressing accessibility.²³⁹

While Project 36 and the Waterfront study address the pollution concern on Hamilton Beach, they attempt to minimize its effects on recreational activities. The Halton-Wentworth Waterfront Study recommends the construction of a tunnel under the Burlington Canal instead of the Skyway Bridge in order to reduce air and noise pollution levels created by the Q.E.W. The study states that until the air quality is improved low intensity recreational uses be planned for.²⁴⁰ The report comments on the highly efficient particulate removal systems installed by the industries across from this area. As well, the report mentions the additional air quality control processes to be put in operation by the industries. The Conservation Authority also attempts to minimize this concern by suggesting that the recreational use of the area has to be coupled with programs to improve water and air quality.²⁴¹ An unofficial study prepared by the city of Hamilton on the recreational use of the Beach comments on the great improvements in air quality over the last ten years. This study suggests that new and tougher air pollution standards will hopefully improve the conditions for future recreational use. Like the Waterfront study, this research indicates that air quality in the Skyway Toll Booth area has been of poorer quality. It states that air quality north and south of this location gradually improves and recommends more intensive recreational use north and south of this point.²⁴² The noise barrier proposed by MTC should also reduce air pollution to some extent and noise pollution significantly.²⁴³ In short, current and projected

pollution levels suggest that Hamilton Beach may not be ideally suited for recreational use.

The water quality of Lake Ontario further limits the recreational potential of Hamilton Beach.

The Seventh Annual Report on Great Lakes Water Quality gives a general picture of the water quality of all the lakes and in particular, Lake Ontario. The report indicates that input of pollutants from upstream lakes contributes to the severity of eutrophication (natural aging process in a water body) and contamination in Lake Ontario.²⁴⁴ The addition of large quantities of nutrients to the lakes speed up the eutrophication process. Phosphorous is largely responsible for the process, which causes excessive growth of algae, depletion of oxygen, increased water treatment costs and the loss of recreational opportunities. While the phosphorous levels declined significantly in the Lake between 1970 and 1978, a problem still exists.²⁴⁵ The contaminant levels of Lake Ontario more or less parallel those in Lake Erie. However, the actual levels of contaminants in Lake Ontario are generally higher than any other Great Lake. Analysis of contaminant levels in several species of fish collected in Lake Ontario during 1978, indicated P.C.B. levels in Lake Trout, Rainbow Trout, and Coho Salmon above the 1978 agreement objective of 1.0 ug/g for whole fish. Mean concentrations of Mirex in Smelts, Lake Trout, Rainbow Trout and Coho Salmon also exceeded the agreement objectives of the International Joint Commission.²⁴⁶ This report states that toxic and hazardous substances are an increasing concern for the entire Great Lakes. While the traditional toxics of mercury and D.D.T.

show declining levels, a number of other substances (with unknown effects) have been identified in the lakes.²⁴⁷ Dioxin in Lake Ontario fish, P.C.T.'s in Lake Erie herring, gull eggs and P.C.B.'s in all lake fish, are of grave concern. According to the report, the list of substances identified to date exceed 450 in number. Some of these substances are known to contribute to serious environmental and human health problems and require strict control.²⁴⁸ The level of toxic and hazardous substances in all of the Great Lakes is a serious and widespread problem with long term effects. The Halton-Wentworth Waterfront Study maintains that Lake Ontario has potential for boating and swimming but frequently large sections of this area's shore are too polluted for body contact.²⁴⁹ During the summer, dominant south westerly winds over the Lake result in a clockwise circulation of the water which carries a plume of pollutants from Hamilton Harbour towards Bronte and Oakville. As a result, high bacterial counts along the north shore make this section of the waterfront generally unsuitable for swimming. A reversal in the wind results in a counter clockwise circulation which transports pollutants to the Hamilton-Burlington area. The water quality along Hamilton Beach and at Confederation Park is unsuitable for swimming approximately 20% of the time as a result.²⁵⁰ The Stoney Creek shore is generally suitable for body contact recreation. The south shore has the best water quality along the Halton-Wentworth Waterfront.²⁵¹

An unofficial study of the city of Hamilton states that the water quality off Hamilton Beach is suitable for body contact, for the most part. This study maintains that the bay

is the major contributor of pollutants along this shore. According to this study, the north east winds blow one third of the time carrying the pollutants from the bay to the Hamilton shore. The research indicates that the effluents flowing out of the bay are at their peak during the summer. As a result, the water quality off Hamilton Beach is at its lowest during the season of its highest probable use.²⁵²

It is likely that much of the Region's population will be reluctant to use Hamilton Beach for water-oriented recreation given the present water quality off this shore. A study conducted by the University of Toronto examined the use of Lake Ontario for recreation among 411 people living around the Lake. The results indicate that only 9% of the people surveyed said that their recreational use of Lake Ontario was unaffected by water pollution. Forty-two percent said their use was slightly affected while 49% said their use was seriously affected by water pollution. It appears that people are becoming more cautious about using Lake Ontario for recreational purposes due to its poor water quality.²⁵³

All of the above studies indicate that water quality limits the use of Lake Ontario and Hamilton Beach for water-oriented recreation.

The water temperature of Lake Ontario is another factor which limits the water-oriented recreational use of this area. In the summer, lake temperatures along Hamilton's shoreline average between 60 and 64 degrees Fahrenheit. These temperatures are too cold for comfortable bathing. When the Lake is warm, it is usually because of the north east winds which also carry polluted

water from the harbour to this shore. The north shore of the Halton-Wentworth waterfront has water temperatures which are 5 degrees Fahrenheit lower than those off the shore of Hamilton Beach so much of the time this shore is also too cold for swimming. The south shore has the highest water temperatures and the best water quality. The Stoney Creek shore, therefore, offers the greatest potential for water-oriented recreation.²⁵⁴

The quality of the sand beach also restricts the area's recreational potential. A soil composition analysis of the Canal area beach revealed that 93.7% of the soil is sand while 5.1% is gravel. The beach quality then decreases as one travels south. At Bell Cairn School the soil composition is approximately 95% gravel. As a result, most of the sand beach is not ideal for sunning and swimming.²⁵⁵ However, conditions on the north and south shores of the Halton-Wentworth waterfront are not much better. The north shore consists of low bluffs. There is a half mile beach at Coronation Park but the water here is too cold for swimming. The south shore is similar to the north shore but it is not as well protected and is eroding. There are some minor sand beaches in this area. The Waterfront Study states that the Stoney Creek shore still offers the highest potential for water-oriented recreation. The study recommends that sand beaches should be established in conjunction with shore protection works.²⁵⁶

A number of features make Hamilton Beach aesthetically unattractive for recreation. The hydro transmission lines along the shoreline are a visual eyesore which detracts from the natural beauty of the waterfront. The Waterfront Study

recommends that the hydro transmission lines be relocated underground, however, this would be very expensive. The study also recognizes that the railway line running adjacent to the sand beach is a limiting factor and proposes its removal. The report also suggests that the Q.E.W. should be reconstructed as a tunnel and the Skyway Bridge be removed to enhance the area's recreational potential.²⁵⁷

An overall evaluation of the arguments used to support the future recreational use of this area reveals that Hamilton Beach is not ideal parkland nor is the recreational use of this area necessary. The recreational potential of this area is limited given the aforementioned factors. It appears that the Stoney Creek waterfront is much more suitable for recreation, especially water-oriented recreation. An evaluation of the supply and demand for regional parkland indicates that this area is not essential as recreational resource. There is an abundant amount of existing and proposed regional open space. There are also numerous existing and proposed waterfront access locations so that this area is not necessary in terms of providing the Region's population with public waterfront access. The need to acquire properties on Hamilton Beach for recreational purposes is questionable given the above arguments.

A Compromise Solution: The Residential And Recreational Use Of Hamilton Beach

The recreational redevelopment of Hamilton Beach is not totally justified. The major problems which affect this neigh-

bourhood are not severe enough to warrant the redevelopment of the entire area. Hamilton Beach does have a number of positive characteristics and they cannot be forgotten when determining the future of this area. While the Beach is not prime residential land, it is not ideal parkland. The area is limited in terms of its recreational potential. It is also not needed as a regional waterfront recreational resource. Evidence indicates that parkland plans for this area do not offer the ideal solution.

An alternative solution exists which can be readily justified. Mixed land use planning is becoming a more popular concept, not only for downtown areas but for waterfronts. A number of Canadian cities have redeveloped and rehabilitated their waterfronts for mixed uses. A mixed residential and recreational use of Hamilton Beach offers a practical solution. It is a solution that would allow both the creation of parkland and the preservation of a community. Such a solution recognizes that homes and parkland can co-exist in a state of complimentary harmony.

Mixed Land Use

Many planners and developers criticize rigid zoning and the segregation of land uses. Some critics say that mono use zoning produces inflexibility and monotony in the city. It is linked with poor access, transportation and communications.²⁵⁸ The segregation of uses has been said to contribute to the prevalent fragmentation of life.²⁵⁹ The periodic emptiness of a single activity district is criticized as being inefficient.²⁶⁰

One critic states:

" We have Balkanized our cities into districts with precise and rigid zoning boundary lines. We have established categories of uses that segregate rather than integrate functional portions of the city and which have often disregarded the interrelationship between widely segregated categories of uses. "261

In the late 1950's and 1960's, planners began to search for a more innovative pattern of land development. The concept of planned unit development or mixed use development was born. Mixed use development is a combination of multiple and district land uses in a single integrated project. Such projects range from the high density urban complex on a small site to a low density suburban development or a new full scale community.²⁶²

The advantages of mixed uses have increased the trend towards planned unit development. A mixture of uses sustains public contact and city safety. On Toronto Islands, a mix of residential and recreational uses provides a measure of safety. The residents' constant presence and surveillance of the park often prevents vandalism, other crimes and accidents. Metro police do not have to patrol the occupied areas of the park as a result.²⁶³

Mixed land use generates variety, creates choices and caters to a wide range of user needs. A variety of housing types and densities are generally associated with planned unit development.²⁶⁴ Mixed use developments generate choices for the consumer. Unique commercial services and shops flourish, offering residents the ability to satisfy their consumer needs.²⁶⁵

Diverse uses provide a more interesting and stimulating environment with the pleasures of contrast, movement and direction.²⁶⁶

In contrast, a suburban environment, with its segregated uses

often produces a monotonous and repetitious area indicating no signs of movement or direction.²⁶⁷ Mixed uses can be economically stimulating as commercial enterprises rely on the demand created by other enterprises to stimulate their own demand. The more intricately mixed and efficient the pools of users are, the greater number of shops and services are needed for market support.²⁶⁸ Combining uses is often the key to making large scale development financially feasible. There are economies of scale associated with mixed use developments, i.e., shared capital costs, operating expenses and certain infrastructural facilities. The provision of public services and facilities such as public transportation, sewers, and other utilities can be organized more efficiently with mixed use development.²⁶⁹ Mixed use development is more efficient than segregating uses because it promotes continuity of movement. There is a constant flow of people at all times in most mixed use districts. Planners realize that mixed use development can prevent the city's core area from emptying out.²⁷⁰ An extensive mix of uses creates controllable compactness. It integrates and improves access between different life functions. A world in which work, residence, and leisure are integrated has been an important goal for many social thinkers.²⁷¹ It makes sense to live, work and play in the same area in terms of the energy, time and money saved.

The idea of variety and mixed use is a persistent theme in much of contemporary planning as a result of the aforementioned advantages. Now zoning ordinances reflect the common sense that puts land uses together in a mutually helpful relationship. The Official Plan for the city of Hamilton allows for mixed land

use development. In the Central Policy Area, a combination of residential, commercial, industrial open space and major institutional uses are permitted where compatibility among adjacent uses can be achieved.²⁷² The City's Planning and Development Department found that a mixed residential/industrial designation was appropriate for the Keith and McNulty Neighbourhoods in the North End. A comprehensive study of the North End revealed that the only realistic alternative for these two enclaves was mixed use. Industry and residents want to remain in the area. Some factories in the area are well kept and make a positive contribution to the neighbourhood while the residential use creates a more human environment for factories. Residents provide local stores, coffee shops, and other services. Economically, it is unfeasible to force the removal of either use. As a result, a review of these two neighbourhoods concluded that the industries in these areas are relatively compatible with the houses, and should be mixed.²⁷³

Mixed Land Use On The Waterfront

A recent trend in waterfront planning is to recapture the shore for redevelopment in a mixed use mode. While the waterfront is recognized as an important recreational resource, it is often the only area where unused land exists in many cities. Therefore the demand for shore land is great and a balance between competing demands must be met. In the U.S., the Committee on Urban Waterfront Land recommends that the recreational use of urban waterfronts be balanced with residential, commercial and industrial uses.²⁷⁴ The Great Lakes Shore Management Guide states

that the waterfront is a place where permanent residences, seasonal residences, recreation and work all exist. The Guide suggests that comprehensive shore management plans take into consideration all of these interests.²⁷⁵ The Conservation Council of Ontario also recommends that a waterfront plan integrate a variety of uses. The key justification for allowing mixed uses on the waterfront is the public nature of waterfronts. It is a place for people. Mixed uses cater to a wide range of needs.²⁷⁶

There are a number of Canadian cities which emphasize the redevelopment of the waterfront in a mixed use mode.

The city of Vancouver has recently expressed greater interest in the development of its shoreline. The waterfront concept selected includes a mix of residential, commercial and recreational uses. The False Creek Project is an example of a mixed use development along this waterfront. The 52 acre site was redeveloped from an industrial ghetto into an innovative mixed use area. The project combines 865 dwellings, 28 acres of public open space, two marinas, an 88 boat home cooperative, and 70,000 square feet of commercial use.²⁷⁷

Quebec City's waterfront has been redeveloped with emphasis on an open space system and a balanced mix of commercial, residential and administrative functions while maintaining the unique historical character and appearance. In the Old Lower Town redevelopment involves: improving the existing housing, encouraging the inflow of administrative and financial organizations to replace warehouses and wholesale operations, restoring historic buildings and creating a marina and park.²⁷⁸

The city of Saint John is orienting the City towards the waterfront. The protection of views, preservation of land marks, renovation of houses and the creation of a network of open spaces are among the guidelines for the redevelopment of this waterfront. Market Square is one of the two major waterfront projects underway. A Civic/Commercial complex will be developed on a 13 acre site. The complex will be comprised of a convention centre, theater, library, art gallery, housing, hotel, offices, public open space and a number of retail services.²⁷⁹

In Toronto, the objective of the Waterfront Plan is to create a handsome waterfront balance in its land uses, which will compliment adjacent areas, recognising existing residential development, and making accessible features which warrant public use.²⁸⁰ Mixed use is slowly returning to the Toronto waterfront through federal land acquisition, private initiative and regulatory means such as mixed zoning districts. The attention of both the citizens and planners is towards combining recreational and residential developments on the Toronto Islands. Mixed use areas, including a residential community, seems to be possible and desirable on the Islands. The two remaining neighbourhoods on Ward and Algonquin Islands present no hindrance to the plans for recreation on the Islands. Park visitors and residents get along well. The park environment contributes to the quality of nearby housing while the houses and residents contribute to the use and character of the park.²⁸¹

The major objective of the Stoney Creek Waterfront Plan is to develop an attractive residential, commercial and recreational environment. The concept plan emphasizes erosion control,

public access and water-oriented recreation, a variety of housing types and the rehabilitation of existing development. The Fruitland Road Interchange is one area along this waterfront to be developed for a mix of residential, tourist, commercial and recreational purposes.²⁸²

A waterfront plan for Hamilton Beach might be modelled after the waterfront plans developed by the cities of Vancouver, Quebec, Saint John, Toronto and Stoney Creek which all emphasize mixed land use.

Mixed Land Use: The Residential And Recreational Use Of Hamilton Beach

Mixed residential/recreational land use on Hamilton Beach could be very beneficial for this waterfront area. A mixed use solution would address the need to preserve and redevelop the neighbourhood. Such a solution would emphasize the complimentary nature of residential and recreational land uses.

Preserving and Rehabilitating the Hamilton Beach Neighbourhood

There is wide support for preserving and upgrading existing neighbourhoods where possible. A number of changes in our society are responsible for the growing interest in the preservation and rehabilitation of older residential areas. All of these changes indicate that at least some of the Hamilton Beach neighbourhood is worth saving.

There are clear signs we are becoming a conservation-oriented society and are leaving behind our consumer-oriented tendencies of the 1960's and 1970's. In the 1960's and 1970's

commodities were used and discarded.²⁸³ This philosophy was even applied to older housing and neighbourhoods with extensive urban renewal during this period. Today, more emphasis is being placed on the rehabilitation of older residential areas. In the mid 1970's the Conservation Authority and the City decided to remove all homes from Hamilton Beach and redevelop the land for open space. A change of attitude in the 1980's indicates that the rehabilitation of this area now appears more desirable.

Energy shortages have increased those arguments which favour preservation. Demolition wastes energy and as the demand for energy conservation increases, the arguments in favour of saving old buildings is strengthened.²⁸⁴ The rising cost of energy and the importance of energy conservation have not influenced the City and Region's parkland plans. The Acquisition Programme has removed 143 residences and will continue until the remaining 455 homes are purchased and demolished.

The high cost of energy has changed people's attitudes towards city living. Many people are relocating closer to downtown areas where work, cultural pursuits, recreation, and entertainment are more readily accessible.²⁸⁵ As more people move back to older, centrally located neighbourhoods, the demand for preserving and rehabilitating these older homes increases. This trend may generate a greater demand for the homes on Hamilton Beach as the cost of energy rises, and the value placed on time increases.

The cost of new construction has also influenced the trend towards preserving and upgrading older homes and buildings.

The cost differential makes older housing more accessible. Older housing generally offers more space per dollar than new housing.²⁸⁶ The cost of housing is becoming a greater concern for people as mortgage rates soar and housing prices rise. It is becoming increasingly difficult for people to obtain affordable accommodations to meet their needs. In Hamilton-Wentworth Region, the need for affordable housing is great while the supply is low.²⁸⁷ Despite the shortage of low cost housing in the Region, the Acquisition Programme continues to remove low cost housing from Hamilton Beach.

The sagging construction industry is another factor which has increased the popularity of preserving and rehabilitating older housing. The level of new construction in Hamilton-Wentworth Region has lead to a shortage of all types of homes.²⁸⁸ The housing shortage increases the arguments in favour of preserving the remaining 455 homes on Hamilton Beach.

The value of the past is growing in importance with much more emphasis being placed on the preservation of housing as a result. Today, there is greater interest in protecting architectural and historical resources of merit.²⁸⁹ The homes on Hamilton Beach provide a link with an important period in Hamilton's history. Many of the homes were built prior to 1920 when the Beach was a fashionable summer resort and possess valuable architectural elements that are now rapidly disappearing.

A greater understanding of the role played by established neighbourhoods has also had an impact on present housing policies.²⁹⁰ The value of established community patterns and facilities are

recognized with the preservation and rehabilitation of older residential areas. Modern planners attempt to retain and foster the sense of community that is often associated with older neighbourhoods. The Hamilton Beach Neighbourhood is a well established community with many families having lived there for a long period. These people have developed a special attachment and feeling for their community.

Aesthetic considerations demand that greater care and effort be taken to preserve and where necessary rehabilitate the existing housing stock. It is believed that older residential areas often have more architectural character and interesting streetscapes than the modern subdivision.²⁹¹ Today there is greater appreciation for homes and neighbourhoods with distinctive character. Hamilton Beach does have a unique atmosphere with a wide range in architecture, interesting mature tree lined streets and proximity to Lake Ontario.

Three levels of government provide economic assistance to preserve and rehabilitate older homes and neighbourhoods and there are three major rehabilitation programmes to help individuals upgrade their homes. At the federal level, Canada Mortgage and Housing Corporation administers the Residential Rehabilitation Assistance Program (R.R.A.P.) which is set up to help home owners and landlords fix up their homes. At present R.R.A.P. assistance for urban areas is available only in specified areas of most Canadian cities. To be eligible for R.R.A.P. assistance a dwelling must be substandard in one of the following five basic areas: structural soundness, fire safety, electrical

wiring, plumbing or heating. Other items may also be eligible for assistance. This programme is aimed at improving the liveability of dwellings and extending their useful life. R.R.A.P. assistance for homeowners is provided in terms of a loan, a portion which need not be repaid (depending on the owner's family income and the extent of repairs). Loans are available up to \$10,000 while the maximum grant available is \$3,750. The Canadian Oil Substitution Programme, The Canadian Home Insulation Programme and the Canada Home Renovation Plan are three other federally funded programmes which may also assist individuals to repair and upgrade their homes.²⁹²

The Ontario Home Renewal Programme (O.H.R.P.) administered by the Ministry of Municipal Affairs and Housing, assists low-income homeowners in upgrading their homes so that they meet the requirements outlined in the City's Property Standards By-Law 74-74. O.H.R.P. is particularly directed to the rehabilitation of substandard dwellings with the emphasis on faulty structural and sanitary conditions as well as the upgrading of plumbing, insulation, heating and electrical systems. The maximum loan available is \$7,500. and the maximum grant is \$2,500. The interest rate on the loan is geared to family income (0% for those under \$3,000, and up to 8% for incomes over \$8,000). To be eligible, home owners's adjusted incomes cannot exceed \$15,500.²⁹³

The City operates the Hamilton Rehabilitation Programme which is designed to provide home owners who do not qualify for federal and provincial assistance with loans for rehabilitation. This municipally sponsored programme is geared to aid young

couples with dependents. To be eligible, the combined family income must not exceed \$20,000. Only loans are available through this programme with a maximum loan of \$7,500. The interest rates on the loan are at 3% for the first five years with the rate being negotiated to the City's prime rate after the first five years.²⁹⁴

Assistance is also available for upgrading neighbourhood services and facilities. The Ministry of Municipal Affairs and Housing administers the Ontario Neighbourhood Improvement Programme (O.N.I.P.). O.N.I.P. is designed to assist Ontario municipalities revitalize deteriorating but potentially stable residential areas occupied by low and moderate income households. The programme helps municipalities to improve municipal services, public utilities, and social and recreational facilities in deteriorating neighbourhoods. A major objective of this programme is to encourage investment in the existing housing stock and new infill development. Under this programme, cost sharing is divided equally between the province and the municipality.²⁹⁵

The various rehabilitation programmes offer a number of advantages. Individual home owners benefit from lower maintenance costs, heating bills and an increase in comfort, convenience and property values. The neighbourhood itself benefits from improvement. Prior to the Ontario Neighbourhood Improvement Programme, the Neighbourhood Improvement Programme proved to be very successful in a number of municipalities. This programme halted the deterioration of residences and improved the visual appearance of older neighbourhoods. This programme was often

responsible for the spin-off of new development and the attraction of new residents once rehabilitation efforts were completed in the designated neighbourhood. Such projects often stimulated residents to upgrade their homes with their own money. Property values generally increased after implementing this programme and the supply of low and moderate income housing was retained.²⁹⁶

Both the residents of Hamilton Beach and the city of Hamilton could benefit from a neighbourhood improvement programme, and the use of the various other rehabilitation programmes in this area. The residents would benefit in terms of reducing maintenance and heating costs and increases in property values. The City would benefit from an increase in the value of real property and an increase in the tax base.

The Redevelopment of Hamilton Beach

The City's park plans and the implementing Acquisition Programme have some merit since Hamilton Beach has a number of physical concerns. It might be possible for parkland to be developed where these concerns group and persist.

Hamilton Beach is an older residential area so that many homes are in need of some repair. The majority of homes are in good condition considering their age. However there are some homes that are in fair/poor to bad condition. These homes either need major rehabilitation or need to be acquired. The Acquisition Programme could again be beneficial in terms of acquiring badly deteriorated homes and replacing them with infill development or parkland.

Certain areas of the Beach could be redeveloped in order to provide additional access to the waterfront. Public access to shore is only meaningful if there is at least minimum space for basic requirements such as parking, suitable slopes for boat launching and some backshore area.²⁹⁷ At the present time, there is little parking and no boat launching areas on Hamilton Beach. The offshore slope around Bell Cairn School is steep so that this area might be developed for boat launching.²⁹⁸ Parking areas could be developed at the Canal area where a large amount of vacant land and the best beach quality exists. Some vacant lots on the Lakeside might also be developed for parking.²⁹⁹

The park plans have some merit as there is a need for additional camping and boating facilities. At this time, only two conservation areas, Confederation Park and the Valens Conservation Area, have camping facilities. The Waterfront Study maintains the demand overpowers the supply of campgrounds at Confederation Park. This study states that the availability of camping sites should be increased in regional parks and recommends that a part of the Beach should be developed for camping purposes.³⁰⁰ An unofficial study conducted by the city of Hamilton came to a similar conclusion. This study indicates that the central section of the Beach would be beneficial for camping considering it is well vegetated and the air and beach quality are acceptable.³⁰¹ This study also came to the conclusion that the area around Bell Cairn School should be developed as a marina because of the steep grade off the shore and the stoney beach in this area. The Great Lakes Shore Management Guide indicates that Hamilton could benefit by developing this

area for boating. The guide reveals that Hamilton is one of the three worst cities, out of 25 centres, in terms of boat launching and boat mooring opportunities per capita.³⁰²

Three levels of government provide economic support for the Acquisition Programme and the redevelopment of Hamilton Beach. The Province contributes 55% of the annual budget for the acquisition of Beach properties. Forty-five percent of the budget is obtained from the city of Hamilton. The City not only provides funding but acquires, and demolishes the structures and maintains the vacant properties. The City's Real Estate Department handles the administration and implementation of the programme along with the Hamilton Region Conservation Authority. The Conservation Authority manages the annual budget for the Acquisition Programme. The City and the Conservation Authority will draft the formal recreational plans once the acquisition programme is completed while the Authority will manage the parkland once it is developed.³⁰³

The cost and complexity of the Beach Strip Acquisition Programme creates several problems. It is costly to acquire, demolish and maintain 550 properties. The cost of the programme will continue to rise with inflation and increasing housing cost. While the cost of the programme has been increasing, the annual budget for the project has been cut back from \$600,000 to \$450,000. As a result, the number of properties acquired each year has declined since 1977.³⁰⁴ All these factors could result in a very long and drawn out death for this community and add a degree of uncertainty for its residents. Cutbacks in funding could eventually reduce the economic

feasibility of the entire programme. The development and management of the program is complex and adds to the problems. The Ministry of Transportation and Communications, Ontario Hydro, C.N.R., the Ministry of Natural Resources, the Harbour Commissioners, the City of Hamilton, the Hamilton Region Conservation Authority, and the remaining 455 home owners all have interests in this area. To avoid serious conflicts of interest negotiation between all these groups is necessary before this area can be redeveloped for parkland. Conflicts already exist between these various parties. For example, there is some evidence of growing conflict between the residents of Hamilton Beach and Regional officials. A recent survey showed that only 15.5% of the residents surveyed agreed with the parkland plans while 94% supported the preservation and upgrading of their community.³⁰⁵ This conflict could grow in time as the list of willing sellers is reduced. Both the cost and the complexity of the Acquisition Programme could be reduced by a compromise solution. The cost of the programme could be reduced significantly if the homes of greatest value were preserved rather than acquired and removed.

Advantages of a Compromise Solution

Neighbourhood preservation and the creation of regional open space are not necessary mutually exclusive aims. Homes and parkland are compatible and can co-exist in a state of complementary harmony. A compromise between homes and parkland would meet both the needs of the people of the region and the residents

of Hamilton Beach.

The Conservation Authority and the city of Hamilton could benefit from a compromise solution. The remaining homes would have a number of positive effects on the use and character of the proposed park.

Recreational uses would be enhanced by the historical character of the neighbourhood. The homes on Hamilton Beach provide an important link with Hamilton's past. Many of the residences were built prior to 1920 and possess unique architectural elements. The homes are reminders of the area's long and colourful history. The homes on Toronto Islands were constructed around the same time as those on Hamilton Beach. A study of the Toronto Island Neighbourhoods concluded that the homes on Algonquin and Ward Islands contribute to the park environment.³⁰⁵ The study states, "is it not worth maintaining (not artificially creating) a piece of small town life with small wooden frame houses, "a village green", that seems several generations removed from the high rise modern city environment?"³⁰⁶ The homes on Hamilton Beach could provide park visitors with a unique experience and a better understanding of this area's history.

It is widely accepted that a park planner should seek to provide a wide range of choice and as many outdoor experiences as possible. The park planner has often been criticized for failing to create the multiple options and complex interactions which once made the waterfront the most fascinating section of any city.³⁰⁷ The remaining homes on Hamilton Beach could increase the options and add variety for park visitors. A stroll through

the residential areas could provide the park visitor with another experience. It would be a unique experience alone to examine a neighbourhood within a park. The residential areas could also provide a welcome change in scale to the pure park areas adding a touch of humanity and everyday life. The study of the Toronto Island Neighbourhoods revealed that the residential use of the Islands provides an animated, colourful backdrop to pure park areas.³⁰⁸

The residents of Hamilton Beach might provide park visitors with a great deal of assistance. The residents on Algonquin and Ward islands perform a number of useful tasks for park visitors. The people of the Islands organize winter carnivals, provide open houses, direct and advise park visitors. The residents of the islands also ensure a measure of safety. A number of park visitors were saved from drowning by residents while residents also warned visitors about such things as skating on thin ice during the winter months. Residents also prevent vandalism and other crimes by being around constantly and informally surveying the park area. Metro police do not have to patrol the occupied areas of the park.³⁰⁹

It is well known that vast areas of open space are intensively used throughout the summer and lie vacant during the winter months. Generally, outdoor recreational areas attract 90% of their visitors during the summer months alone.³¹⁰ Mixed uses would ensure the constant use of Hamilton Beach. Permanent residents would actually attract additional visitors to the park.

Beach residents would also benefit from this compromise solution. A large urban park would have a number of positive

effects on the residential environment.

Open space is an important aesthetic resource. It enhances urban design and provides a break in the monotony of urban development. Hamilton Beach would benefit from the attractive views created by parkland. The residents might also benefit from the change in residential character. Park visitors would bring more variety to this neighbourhood.³¹¹

The residents of this area as well as the people of the Region would benefit from additional parkland. Open space provides a place where people can relax, seek solitude, get away from urban pressures, play and return to nature. The residents of Hamilton Beach could benefit most from the additional recreational facilities that a large urban park would bring to their community.

A large urban park would most surely increase property values on Hamilton Beach. Research shows that open space has a positive effect on the capital and rental value of nearby properties in both low and high income areas. In many cities, parks have increased nearby property values.³¹² The decade following the initial construction of New York's Central Park saw an enormous increase in the value of land in Central and Upper Manhattan much of which, can be directly attributed to the creation of the park.³¹³ Increased property values might encourage residents to remain on Hamilton Beach and upgrade their properties.

There is wide support for mixed land use on Hamilton Beach. Mixed use development is becoming more popular in downtown areas and on the waterfront. Many Canadian cities have come to recognize

that the waterfront is a public resource which should include a variety and balance of uses to accomodate a wide range of needs. These cities have realized the advantages of greater safety, convenience, diversity, efficiency and flexibility that mixed land use development provides.

Conclusion

Research indicates that the Acquisition Programme and park plans might be more effective if they were combined with the preservation and rehabilitation of the Hamilton Beach neighbourhood.

A complete evaluation of the residential use of Hamilton Beach reveals that the Acquisition Programme, is not easily justified in its present form. An evaluation of the neighbourhood reveals that Hamilton Beach has many advantages as a residential area as well as some potential concerns. All the advantages provide strong support for the preservation and rehabilitation of this neighbourhood. The existing concerns do not justify the removal of the area's residential character.

An evaluation of the future recreational use of Hamilton Beach indicates that the recreational potential of this area is limited. A closer examination of the supply and demand for regional parkland reveals that Hamilton Beach is not essential for recreational purposes. Research shows that it is unnecessary to redevelop this entire waterfront area in order to provide the Region's population with access to the waterfront. The three major arguments used to support the park plans do not justify

the exclusive recreational use of Hamilton Beach.

A compromise between the present residential use and the future recreational use of Hamilton Beach is readily justified. A mixed use solution would preserve the residential areas of greatest value while utilizing other areas for parkland. A compromise solution would accomodate the need for improved access to this waterfront area and for certain recreational facilities. Mixed use development would actually enhance the proposed park and the future of Hamilton Beach. Research reveals that not only are the residential and recreational uses compatible but also mutually support each other. A mixed residential/recreational designation for Hamilton Beach might create a more efficient, attractive, diverse, safe and healthy environment. A mixed use solution would consider the needs of Beach residents, the city of Hamilton and the Conservation Authority.

CONCLUSIONS AND RECOMMENDATIONS

Having analyzed the neighbourhood concerns expressed by Regional officials, this study group has come to the conclusion that Hamilton Beach is suitable for permanent residential use and should retain its residential character. We base our conclusion on a number of findings brought to light during the course of this study:

* Both seasonal and permanent residences have always existed on Hamilton Beach and there is a strong desire among residents to remain in the neighbourhood.

* The air quality on the Beach has improved dramatically since the early 1970's and will continue to improve. Noise levels will be lowered significantly by MTC when berms are constructed along highway improvements in the near future.

* Hamilton Beach is not prone to surface water flooding or wave damage and only certain areas of the Beach are subject to problematic high water tables. Even where water tables cause concern, they should not influence a decision to preserve the Beach since any potential problem they create can be overcome.

* No concrete evidence exists at present to suggest that human health is being endangered by the operation of private sewage systems on Hamilton Beach. If problems do exist, they can be eliminated with proper maintenance and the installation of improved private systems. A public sewerage alternative is technologically feasible on Hamilton Beach and the cost of this alternative would be greatly reduced by hooking sewer lines

up to the proposed Eastport Industrial Park.

* The majority of structures on Hamilton Beach are either in standard condition or can be rehabilitated.

Consequently, this study group believes that both the goal to provide access to Lake Ontario via Hamilton Beach and the objective to transform Hamilton Beach into regional parkland, are inadequate since Regional officials did not thoroughly investigate existing access to Lake Ontario and the potential of the Beach Neighbourhood. Adequate access to the lakeshore already exists via area sidestreets and existing neighbourhood parks. It must be emphasized that the lakeshore is either leased by the Crown to Ontario Hydro or is owned by Ontario Hydro. The lakeshore is not owned by residential property owners.

As an alternative, the City of Hamilton should seriously consider allowing mixed use development on Hamilton Beach. Our research shows that a variety of mixed land uses, including parkland, could and should be developed on Hamilton Beach. In light of this conclusion, some preliminary recommendations are:

* A waterfront plan for Hamilton Beach should balance recreational land use with residential, commercial and institutional uses. A mixed recreational-residential zoning district would implement this strategy.

* Pending the results of the proposed neighbourhood study, the Land Acquisition Programme should be modified to allow structures to be acquired on a block-by-block basis and only in areas where recreational facilities would be most appropriate.

* Vacant properties not suitable for recreational development

should be packaged and made available for infill residential and commercial development. Although the Official Plan for the City of Hamilton does not allow new development or redevelopment that cannot be hooked up to the regional sewer system, the City can permit infill development on temporary sewage disposal systems in areas where considerable development already exists provided they can be connected to the regional system when the system is extended to the area.³¹⁴ Infill development and the additional revenue it creates, would make the extension of the regional system to the Beach more feasible.

* Homes in the best condition and of the greatest value should be preserved while severely deteriorated homes should be replaced by either infill development or parkland. Only 1.5% of the homes are dilapidated while 10.1% of the homes are in poor condition. The neighbourhood would benefit from the removal of these homes if rehabilitation were possible.

* A special effort should be made to preserve homes and other community buildings of historic and architectural significance, that exist on Hamilton Beach. The 49 homes built prior to 1900 may be of special interest as well as the various churches, the firehall and the school.

* The City should investigate the possibility of obtaining funding from the Ontario Neighbourhood Improvement Programme. Funding can be obtained from this programme to improve social and recreational facilities, neighbourhood services and utilities.

* Beach residents should be made aware of available housing rehabilitation programmes. Information on the Residential

Rehabilitation Assistance Programme, the Ontario Home Renewal Programme, the Hamilton Rehabilitation Programme, the Canada Home Renovation Plan, the Canada Home Insulation Programme and the Canada Oil Substitution Programme, might be distributed to area residents to encourage them to upgrade their homes. All of these programmes offer assistance to individual homeowners.

* Once major rehabilitation efforts are underway, the City might continue its acquisition of homes on the priority lists of the Land Acquisition Programme if property owners are unable to sell their homes on the private market.

* Public access to Hamilton Beach could be improved by providing space for parking, suitable slopes for boat launching and developing some backshore areas of the sand beach.

* The Canal area represents the best land for development of water-orientated recreation. This area has the best beach quality and the offshore slope is not too steep for swimming.

* A marina could be developed on the sand beach around Bell Cairn School. The steep grade of the offshore slope make this area ideal for boating while the steep grade and the gravel content of the beach limit swimming and sunning in this area.

* Land-oriented recreation should predominate on Hamilton Beach due to the poor quality and low temperature of offshore water. If campgrounds are developed on the Beach, they should be located in areas unsuitable for permanent residential use.

* Year round recreational elements should be developed on the Beach to ensure that parkland is well used at all times of the

year. To help achieve this goal, the vacant school building could be developed as a recreation and culture centre for neighbourhood residents and park visitors.

* Instead of waiting for the completion of the Land Acquisition Programme before planning the future of Hamilton Beach, the City of Hamilton should begin this process now so that a more logical, phased acquisition scheme can be facilitated.

* A coordinating committee should be organized to improve communications between the various groups having interests on Hamilton Beach. Representatives of the Hamilton Region Conservation Authority, the City of Hamilton and most importantly, the residents of Hamilton Beach, should be included on a committee to coordinate the future plans for the area.

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Ottawa Area 1960-1961

	Date	Index	No. of Days
1960			
1.	April 7	32	1
2.	April 23	32	1
3.	September 13	32	22
4.	October 16-17	30	24
5.	December 23	30	1
1961			
1.	February 18-20	32	72
2.	Mar 5	32	1
3.	June 2	32	1
4.	June 3	32	1
5.	June 13	32	1
6.	July 2-3	32	12
7.	October 19-21	32	12
8.	December 16-17	30	12

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TABLE 1

Air Pollution Index
Occasions When 32 or Above

	<u>Date</u>	<u>Maximum</u>	<u>No. of Hours</u> <u>32</u>
1980	1. April 7	32	4
	2. April 23	32	3
	3. September 13	39	22
	4. October 16-17	40	39
	5. December 28	32	3
1981*	1. February 19-20	32	13
	2. May 5	34	9
	3. June 2	32	5
	4. June 3	33	5
	5. June 13	32	6
	6. July 2-3	34	18
	7. October 14-15	34	19
	8. November 14-15	38	43

Source: Ontario Ministry of the Environment, 1980 Hamilton Air Quality, July 1981.

*Source: Ontario Ministry of the Environment, Unpublished data on 1981 Hamilton air quality.

TABLE 2
Suspended Particulates
1978 - 1981

UNITS: Micrograms per cubic meter

ONTARIO OBJECTIVES: 24 hour= 120

1 year geometric mean= 60

	Geometric Mean			
	1981	1980	1979	1978
29001 - Hughson/Hunter		71	78	64
29007 - City Hall		59	60	61
29008 - North Park	86	95	96	93
29011 - Burlington-Leeds		124	123	133
29012 - Burlington-Wellington		73	76	74
29017 - Chatham-Frid		84	91	77
29025 - Barton-Sanford	82	88	100	102
29085 - Mountain Police Station		56	61 ⁹	-
29092 - Bell Cairn School	71	-	-	-
29090 - Westdale Library		67 ⁵	-	-

Source: Data appearing in Tables 1-14 has been extracted from the following sources:
Ministry of the Environment, 1979 Hamilton Air Quality
July 1980. Ministry of the Environment, 1980 Hamilton
Air Quality, July 1981. Unpublished 1981 data obtained from
the Ontario Ministry of the Environment, Technical Support
Section, West Central Region.

TABLE 3

Suspended Particulates For Three Selected Stations
1981

UNITS: Micrograms per cubic meter

ONTARIO OBJECTIVES: 24 hour = 120

1 year geometric mean = 60

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Park	114	126	110	94	96	98	90	66	59	42	56	76
Bell Cairn	70	114	89	108	30	91	76	58	80	39	35	60
Barton/Sanford	67	85	89	85	120	109	95	84	62	71	72	50

	<u>Yearly Average</u>	<u>No. of Times Over Hourly Objective</u>
North Park	86	65
Bell Cairn School	71	8 (out of 48 readings)
Barton/Sanford	82	46

TABLE 4

Soiling Index (1977-1981)

UNITS: COH's per 1000 linear ft. of air

ONTARIO OBJECTIVES: 24 hour = 1.0

1 year = 0.5

	<u>Annual Average</u>					<u>No. of Times Above Objective 24-hour</u>		
	1981	1980	1979	1978	1977	1981	1980	1979
North Park	.72	.72	.73	.67	.63	-	81	73
Barton/Sanford	.58	.54	.63	.56	.54	-	20	55

TABLE 5
Dustfall 1977 - 1981

UNITS: grams/sq. meter/30 days

Ontario Objectives: 1 month avg. = 7.0
1 year avg. = 4.5

AREA	STATION NO.	1977	1978	1979	1980	1981
Beach Strip	29008	17.7	12.6	13.8	13.9	13.4
	29084	-	-	6.4	7.4	8.5**
	29044	11.9	11.6	11.7	9.6	8.3
Burlington	29046	7.2	6.7	4.8	4.2	3.0*
Central	29001	8.2	6.5	7.5	6.5	8.0
Hamilton						
North Central	29025	11.5	9.5	10.7	9.0	9.0
Hamilton						
North End	29067	7.6	5.8	6.1	5.9	6.1
	29012	11.1	10.4	8.8	9.5	8.4
Industrial Area	29011	14.6	14.9	16.3	14.8	13.5
	29010	14.6	14.4	17.4	19.5	25.9
	29037	17.3	16.1	24.8	21.1	23.5
	29036	11.3	10.6	14.7	10.9	11.9
South East	29009	6.4	6.1	5.9	5.1	6.0
	29006	9.1	8.0	6.2	6.4	6.6
North East	29082	8.3	7.7	8.5	7.2	9.5
	29026	5.0	5.0	5.3	5.8	7.0
Mountain	29031	7.2	7.5	8.0	6.3	7.0
	29019	6.1	4.2	4.5	3.5	3.9
	29030	6.5	6.3	5.0	5.7	5.8
West End	29017	10.3	10.6	9.5	10.6	11.9*
YEARLY AVERAGE OVER ALL STATIONS		10.3'	9.3'	10.0	9.3	9.9

* for 10 months only

** for 9 months only

' for 18 stations

TABLE 6

Sulphur Dioxide 1977 - 1981

UNITS: Parts per Million

Ontario Objectives: 1 hour = .25
 24 hour = .10
 1 year = .02

		Annual Average	Maximum 1-hour	No. of Times Above Objective 1-hour
North Park	1981	.014	.12	0
	1980	.014	.13	0
	1979	.012	.14	0
	1978	.013	.13	0
	1977	.017	.15	0
Barton/Sanford 1981	1981	.010	.14	0
	1980	.013	.16	0
	1979	.017	.25	0
	1978	.016	.29	1
	1977	.023	.17	0

TABLE 7

Total Reduced Sulphur (1977-1981)

UNITS: Parts per Million

Ontario Objective: 1-hour = 20 (Hydrogen Sulphide)

		Annual Average	Maximum	No. of Times Above Objective
North Park	1981	1.9	47	20
	1980	1.8	44	26
	1979	1.6	32	3
	1978	1.2	36	5
	1977	0.8	26	2
Barton/Sanford	1981	1.4	83	45
	1980	0.9	61	26
	1979	2.4	144	75
	1978	1.6	66	74
	1977	1.3	110	65

TABLE 8

Carbon Monoxide (1977-1981)

UNITS: Parts Per Million

Ontario Objectives: 1-hour = 30
8-hour = 13

		Annual Average	Maximum 1-hour	No. of Times Above Objective 1-hour
Barton/Sanford	1981	1.2	15	0
	1980	0.9	10	0
	1979	1.5	14	0
	1978	1.2	9	0
	1977	1.4	12	0

TABLE 9

Nitrogen Dioxide and Nitric Oxide (1977-1981)

UNITS: Parts per Million

Ontario Objectives: 1-hour = .20
24-hour = .10

		Annual Average	Maximum		No. of Times Above Objective	
			1-hour	24-hour	1-hour	24-hour
North Park	1981	.027	-	-	3	-
	1980	.028	.15	.10	0	0
	1979	.034	.16	.10	0	0
	1978	.040	.14	.11	0	1
	1977	.045	.20	.14	0	3
Barton/Sanford	1981	.029	.15	-	0	-
	1980	.027	.15	.06	0	0
	1979	.029	.12	.07	0	0
	1978	.046	.18	.12	0	3
	1977	.057	.18	.13	0	2

TABLE 10

Nitric Oxides (1977-1981)

UNITS: Parts per Million

		Annual Average	Maximum	
			1-hour	24-hour
North Park	1981	.061	.67	-
	1980	.065	.52	.16
	1979	.068	1.00	.23
	1978	.069	.69	.24
	1977	.073	.71	.34
Barton/Sanford	1981	.019	.35	-
	1980	.021	.43	.13
	1979	.030	.78	.43
	1978	.026	.60	.15
	1977	.030	.55	.26

TABLE 11

Nitrogen Oxides (1977-1981)

UNITS: Parts per Million

			Maximum	
Annual Average			1-hour	24-hour
North Park	1981	.088	-	-
	1980	.093	.55	.21
	1979	.101	1.04	.30
	1978	.110	.76	.30
	1977	.117	.77	.40
Barton/Sanford	1981	.048	-	-
	1980	.046	.34	.12
	1979	.059	.88	.50
	1978	.073	.64	.22
	1977	.086	.63	.36

TABLE 12

Ozone (1977-1981)

UNITS: Parts per Billion

Ontario Objective: 1-hour -80

		Annual Average	Maximum	No. of Times Above Objective
Barton/Sanford	1981	16.3	90	16
	1980	17.4	107	24
	1979	15.3	112	32
	1978	16.3	119	71
	1977	16.6	92	15

TABLE 13

Fluoride-1981-(fluoridation rate by lime candle)

units: $\mu\text{gF}/100 \text{ cm}^2/30 \text{ days}$

STATION	LOCATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
29001	Hughson/ Hunter North Park	20	29	24	26	54	35	24	26	18	22	69	-	32
29008		121	146	101	106	56	106	50	33	45	29	36	78	76
29012	Burlington/ Wellington Chatham/Frid	26	24	18	32	46	33	30	25	23	20	28	32	28
29017		36	35	35	49	72	66	29	98	33	24	37	30	45
29025	Barton/Sanford	26	28	31	39	52	51	37	33	23	22	30	24	33
29026	Woodward	33	37	39	45	31	51	33	30	23	19	33	31	34
29054	Beach rd/Conrad	46	86	101	71	58	63	121	48	54	47	37	71	67
29058	QEW near Beach cutoff	138	193	137	93	117	155	101	53	54	54	92	127	110
29059	Burlington/Gage	80	126	89	98	194	86	86	69	48	73	65	64	90
29062	Briarwood School	75	98	101	76	78	109	50	57	59	60	117	47	77
29066	Killarney/ Beach Blvd.	89	108	77	78	46	51	34	28	29	26	36	64	56

TABLE 14

Dustfall Level And Proximity To Industrial Sector

<u>RANK</u>	<u>STATION NO.</u>	<u>LOCATION</u>	<u>DUSTFALL</u>
1	29019	South mountain	3.9
2	29030	South mountain	5.8
3	29017	West Hamilton	11.9
4	29031	Mountain near Brow	7.0
5	29001	Central Hamilton	8.0
6	29046	OPP building Burlington	3.0
7	29006	Parkdale and Main	6.6
8	29067	North End	6.1
9	29008	North Park Ave.	13.4
10	29009	Kenilworth North	6.0
11	29084	Beach area	8.5
12	29012	North End	8.4
13	29025	North central	9.0
14	29026	East/woodward/brampton	7.0
15	29044	Hamilton Beach near industrial sector	8.3
16	29036	near industrial sect.	11.9
17	29082	" " "	9.5
18	29011	" " "	13.5
19	29037	Industrial sector	23.5
20	29010	Industrial sector	25.9

Rank: 1= farthest from industrial sector
20= closest to industrial sector

Units: grams/sq.m./30 days.

TABLE 15

Acoustical Barriers Constructed In Toronto

Type number	Barrier description	Location	Thickness, in inches (centimetres)	Height in feet (metres)	Total length in feet (metres)	Type of support	Material of the barrier	Actual cost ^a per linear foot (metre), in dollars	Approximate cost ^a , in dollars, per linear foot (metre) of 10-ft (3 m) high barrier
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Precast concrete wall	Highway No. 401, Willowridge Road Clarion Road	6 (15)	8½-11 (2.6-3.4)	2021 (616)	Concrete H columns 25 ft (7.6 m) apart	Reinforced concrete 4000 psi (276 bar) at 28 days	48 (157)	42 (138)
2	Earth berm	Highway No. 401, HEPC Field Arkley Crescent	60(150) on top	9-10 (2.7-3.0)	1010 (308)	—	Earth fill, topsoil, sodding	25 (82)	25 (82)
3	Precast cellular concrete wall	Highway No. 401, Clarion Road	6 (15)	8½ (2.6)	800 (244)	Steel columns 8123 20 ft (6.1 m) apart	Reinforced concrete 600 psi (41 bar) at 28 days density 35 pcf (560 kg/m ³)	44 (144)	33 (100)
4	Precast cellular concrete wall, on top of earth berm, 5-8 ft (1.5-2.4 m) high	Highway No. 401, Wetherbury Drive	4 (10)	3½-7½ (1.1-2.3)	1630 (502)	Steel columns 61 12.5 10 ft (3 m) apart	Reinforced concrete 600 psi (41 bar) at 28 days density 35 pcf (560 kg/m ³)	36 ^b (118) ^c	36 (118)
5	Precast cellular concrete wall	Highway No. 401, Arkley Crescent	4 (10)	9 (2.7)	690 (210)	Steel columns 61 12.5 10 ft (3 m) apart	Reinforced concrete 600 psi (41 bar) at 28 days density 35 pcf (560 kg/m ³)	41 (135)	45 (148)
6	Aluminum wall	Don Valley Parkway, Fenelon Drive	3½ (9)	8" (2.4) ^c	720 (219)	Aluminum H columns 18 ft (5.5 m) apart	½ in. (3.2 mm) aluminum plate	40 (131)	40 (131)
7	Wooden wall	Don Valley Parkway, Larabee Crescent	½ (1.9)	9 (2.7)	400 (122)	Structure attached to fence	Treated fir plywood panels	12 (39)	15 (49)
8	Gabion wall	Don Valley Parkway, Groveland Crescent	36 (91)	8" (2.4) ^c	810 (247)	—	Rock in wire baskets	80-90 (262-295)	60 (197)
9	Porous concrete wall	Don Valley Parkway, Cassandra Boulevard	4 (10)	12 (3.7)	1400 (427)	Steel columns 10 ft (3 m) apart	Reinforced low density concrete 40 pcf (640 kg/m ³)	33 (115)	30 (98)

^a Excludes costs of engineering and relocation of sewers. ^b 5 ft (1.5 m) high wall plus 5 ft (1.5 m) high earth berm. ^c Above edge of pavement.

Source: D. Hothersal and R. Salter, Transportation and the Environment, (Crosby, Locwood, Staples, 1977) p. 127.

TABLE 16

Sound Level Limits

INDOOR SOUND LEVEL LIMITS

Type of Space	Equivalent Sound Level (L_{eq}) dBA
Bedrooms, sleeping quarter, hospitals, etc. (time period 2300 hrs - 0700 hrs)	40
Living rooms, hotels, motels, etc. (time period 0700 hrs - 2300 hrs)	45
Individual or semi-private offices, small conference rooms, reading rooms, classrooms, etc. (time period 0700 hrs - 2300 hrs)	45
General offices, reception areas retail shops and stores, etc (time period 0700 hrs - 2300 hrs)	50

SOUND LEVEL LIMITS FOR OUTDOOR
AREAS (2300 - 0700 hours)

Sound Descriptor for the Entire Period	Sound Level Limit dBA
L_{50}	47
L_{eq}	50

SOUND LEVEL LIMITS FOR OUTDOOR
RECREATIONAL AREAS (0700 - 2300 hours)

Sound Descriptor for the Entire Period	Sound Level Limit dBA
L_{50}	52
L_{eq}	55

Source: Ontario Ministry of the Environment, Acoustics Technology in Land Use Planning, Volume 2, Road Traffic Noise Tables, July 1977, p. 239

TABLE 17a

Noise Measurements (location no. 1-7)

Location	Distance from Q. E. W.	1972/73		1978/79	
		Noise Level (L ₁₀ dBA)	Date & Time	Noise Level (L ₁₀ dBA)	Date & Time
1. 1,200'± West of Guelph South of Q. E. W.	60' 330' 620'	80 63 57	10/June/72 9:00-10:00 a.m.		
2. 1,600'± East of Brant South of Q. E. W.	85' 340' 600' 850'	74 72 63 60	10/June/72 10:30-11:30 p.m.	78	1/Dec. /78 1:00-1:30 p.m.
3. 1,000'± East of Brant South of Q. E. W.	100' 720' 1,400'	79 62 67	28/June/72 9:30-10:30 a.m.		
4. 2,500'± North of Plains East of Q. E. W.	300' 450' 750'	75 68 61	6/March/73 10:30-11:30 p.m.		
5. 1,200'± South of Plains West of Q. E. W.	40' 370' 700'	78 69 61	7/March/73 12:00-2:00 a.m.		
5. 2,300'± South of Plains East of Q. E. W.	50' 500' 900'	82 64 60	14/June/72 11:00-2:00 p.m.		
7. 2,600'± South of Plains West of Q. E. W.	50' 340' 680'	77 66 57	7/March/73 2:30-3:30 a.m.	85 58 63	29/Nov. /78 3:00-5:00 p.m.

TABLE 17b

Noise Measurements (location no. 8-14)

Location	Distance from Q. E. W.	1972/73		1978/79	
		Noise Level (L ₁₀ dBA)	Date & Time	Noise Level (L ₁₀ dBA)	Date & Time
8. 800'± North of Canal East of Q. E. W.	Under Skyway 310' 450'	69 72 70	21/June/72 9:00-12:00 noon		
9. 5,800'± South of Canal East of Q. E. W.	70' 250' 620'	78 75 67	1/July/72 11:00-12:00 noon	83 79 75	29/Nov./78 9:30-11:30 a.m.
10. 1,000'± North of South Access East of Q. E. W.	40' 270' 530'	74 64 75	7/March/73 7:00-8:00 a.m.		
11. 3,000'± South of South Access East of Q. E. W.	70' 205' 330'	75 67 70	21/June/72 2:30-10:30 a.m.		
12. 600'± North of Hwy. 2 West of Q. E. W.	630' 920'	60 63	7/March/73 4:00-4:30 a.m.	64 65	29/Nov./78 1:30-2:30 p.m.
13. 700'± South of Hwy. 2 West of Q. E. W.	300'			68	29/Nov./78 11:00-12:00 noon
14. 2,800'± West of Guelph North of Q. E. W.	100' 570' 950'	68 64 71	6/March/73 7:30-8:30 p.m.		

Source: Ontario Ministry of Transportation and Communications, Queen Elizabeth Way, Environmental Assessment Report, November 1979, pp. 138, 139.

TABLE 18

Sound Level Measurements for Certain
Hamilton Areas

	<u>L10 (dBA)</u>	<u>TIME</u>
<u>HAMILTON BEACH *</u>		
Location no. 8	69 - 72	0900 - 1200 hrs.
Location no. 9	67 - 78	1100 - 1200 hrs.
Location no. 10	64 - 75	0700 - 0800 hrs.
Location no. 11	67 - 75	0230 - 1030 hrs.

HAMILTON **

Residential/commercial	69.5 - 75.0	Daytime
	68.0 - 71.0	Evening
	63.8 - 83.4	Night
Commercial/downtown	74.5 - 80.0	Daytime
	70.7 - 79.4	Evening
	66.3 - 83.4	Night
Industrial/residential	61.4 - 81.6	Daytime
	57.0 - 78.6	Evening
	54.7 - 81.2	Night

*Source: Ontario Ministry of Transportation and Communications, Queen Elizabeth Way, Environmental Assessment Report, November 1979.

**Source: Ontario Ministry of the Environment, N. Shah, D. Benwell, and R. Korol, Hamilton Noise Survey, Summer 1972.

TABLE 19

Mean Levels For Lake Ontario By Month For All Years
And Since 1971

Month	All Years		Since 1971	
	m.	ft.	m.	ft.
January	74.37	245.42	74.54	245.98
February	74.40	245.52	74.60	246.18
March	74.49	245.82	74.70	246.51
April	74.69	246.48	74.89	247.14
May	74.83	246.94	75.08	247.76
June	74.87	247.07	75.08	247.76
July	74.80	246.84	74.83	247.07
August	74.73	246.61	74.81	246.94
September	74.59	246.15	74.71	246.54
October	74.47	245.79	74.55	246.02
November	74.39	245.49	74.43	245.62
December	74.37	245.42	74.42	245.59

Source: Canadian Hydrographic Service, Department of Fisheries and Oceans/Inland Waters Directorate, Department of the Environment, Monthly Water Level Bulletin: Great Lakes and Montreal Harbour, January to December, 1981.

TABLE 20

Land Elevation On Hamilton Beach

Location (block)	Highest Elevation		Lowest Elevation	
	m.	ft.	m.	ft.
(Lakeside)				
To Fitch	77.60	256.08	77.20	254.76
Fitch to Mareve	77.60	256.08	77.00	254.10
Mareve to Dynes Park	77.30	255.09	77.00	254.10
Dynes Park to Fifth	77.40	255.42	77.00	254.10
Fifth to Lakeside	77.40	255.42	77.00	254.10
Lakeside to Sierra	78.20	258.06	77.00	254.10
Sierra to Dexter	77.60	256.08	77.00	254.10
Dexter to Woodland	77.30	255.09	77.10	254.43
Woodland to Killarney	77.90	257.07	77.20	254.76
Killarney to Locarno	77.80	256.74	76.80	253.44
Locarno to Fifth	77.20	254.76	76.80	253.44
Fifth to Fourth	77.20	254.76	76.90	253.77
Fourth to Third	77.20	254.76	76.70	253.11
Third to Pandora	77.20	254.76	76.60	252.78
Pandora to Manor	77.20	254.76	76.60	252.78
Manor to Canal	77.80	256.74	76.60	252.78

Land rises in elevation from Beach Blvd. to Lake Ontario.

(Bayside)

to Kirk	77.00	254.10	75.60	249.48
Kirk to Wark	76.60	252.78	75.80	250.14
Wark to Bayside	76.90	253.77	75.60	249.48

Bayside to Towers	76.90	253.77	75.80	250.14
Towers to Arden	77.80	256.74	75.40	248.82
Arden to Lagoon	77.00	254.10	75.90	250.47
Lagoon to Clare	77.30	255.09	75.80	250.14
Clare to Granville	77.40	255.42	75.60	249.48
Granville to Comet	77.30	255.09	75.60	249.48
Comet to Grafton	77.10	254.43	75.60	249.48
Grafton to Wickham	77.10	254.43	75.70	249.81
Wickham to Knapman's	77.10	254.43	75.80	250.14
Knapman's to Windermere	77.10	254.43	75.80	250.14
Windermere to Rembe	77.10	254.43	75.70	249.81
Rembe to North Park	77.10	254.43	75.70	249.81
North Park to Renfrew	77.10	254.43	75.70	249.81
Renfrew to Locarno	77.10	254.43	75.70	249.81
Locarno to Dunraven	77.10	254.43	75.70	249.81
Dunraven to Canal	77.10	254.43	75.70	249.81

Land rises in elevation from the Q.E.W. to Beach Blvd.

Source: Ontario Ministry of Transportation and Communications,
Highway Engineering Division, Plan: Q.E.W., Regional Municipality
of Hamilton-Wentworth, Nov., 1979.

TABLE 21

Catch-Basins And Drainage Ditches On Hamilton
Beach Side Streets

Location (street)	Catch-Basins	Drainage Ditches
(Lakeside)		
Mareve	2	
Fitch	2	
Dexter	1	
Woodland		1
Killarney	1	
Locarno	2	
Fifth	1	
Fourth	1	
Third	1	
Manor	1	
(Bayside)		
Wark	1	
Bayside	2	
Q.E.W. Cutoff		1
Comet	2	
Knapman's	1	
Dunraven	1	

Sources: City of Hamilton, Hamilton Storm Drainage Plans, Jan., 1969. Field Survey, April 26, 1982.

TABLE 22

Shore Damage ^a Resulting From The 1972-1973 Storms
On Lake Ontario

County or Regional Municipality	Shoreline (km.)	Total Damage (\$)	Total Damage (\$)
Niagara	49.09	648,457	13,210
Hamilton-Wentworth	18.31	130,418	7,123
Hamilton-Burlington ^b Beach	6.50	47,123	7,249
Halton	26.90	707,811	26,113
Peel	14.72	532,757	36,193
Metro Toronto	46.82	585,903	12,514
Durham	64.92	108,741	1,675
Northumberland	114.03	189,086	1,658
Prince Edward	289.54	127,319	440
Hastings	68.12	26,026	382
Lennox, Addington	156.59	45,561	291
Frontenac	212.92	91,749	431
Total	1,062.47	3,240,951	3,052

^a Damage from inundation and wave uprush.

^b Includes heavy damage on Burlington Beach due to severe wave uprush.

Adapted from: Environment Canada, Ontario Ministry of Natural Resources, Canada, Ontario Great Lakes Shore Damage Survey, Oct. 1975, p. 45.

TABLE 23

Land Use Distribution On Hamilton Beach

<u>Land Use</u>	<u>Acres</u>	<u>Hectares</u>	<u>Percentage</u>
1. Residential Individual			
a. Single Family Dwellings	58.8	23.7	25.
b. Duplexes	8.6	3.5	3.7
c. Other plexes	9.2	3.7	3.9
2. Residential Collective (hotels, motels)	.6	.2	.3
3. Open Space			
a. Public	7.0	2.8	3.0
b. Private	.3	.1	.3
c. Vacant Land	94.6	38.3	40.3
4. Institutional			
a. Churches	.7	.3	.3
b. Public Schools	.7	.3	.3
c. Clubs, Community Centres	.8	.3	.3
5. Retail Products and Services			
a. Restaurants, Taverns	2.2	.9	.9
b. Retail Stores	1.9	.8	.8
c. Retail Services	.7	.3	.3
d. Gas Stations	1.9	.8	.8
e. Sholesale	.4	.2	-
6. Transportation, Communications Utilities, Parking			
a. Buildings & Structures	30.7	12.4	13.1
b. Rights-of-Way	15.2	6.2	6.5

Source: City of Hamilton Land Use Data updated by 1981 Tax Assessment Rolls

TABLE 24

Enrollments For Bell Cairn Memorial School

<u>Year</u>	<u>Enrollment</u>
1970	593
1971	523
1972	512
1973	465
1974	400
1975	396
1976	322
1977	279
1978	219
1979	111
1980	88
1981*	78
1982*	87

* projected enrollment

Ministry's rated School capacity = 766

Operating capacity for the School = 613

Source: L.D.McCowell, J.L. Pikor, W.M. Cain, Hamilton Beach in Retrospect, Hamilton, Summer 1981, p. 74 .

TABLE 25

Housing Conditions On Hamilton Beach (%)

Condition	Bayside		Lakeside		Average
	Beach Boulevard	Side Streets	Beach Boulevard	Side Streets	
Good	43	11.9	42	20.5	32.1
Good/Fair	9.1	7.9	9.5	20.5	10.1
Fair	25.6	48.4	24.3	43.6	32.5
Fair/Poor	14.9	19.0	10.1	10.3	13.8
Poor	4.1	12.7	12.4	5.1	10.0
Bad	3.3	0	1.8	0	1.5
	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Windshield Survey conducted January, 1982

TABLE 26

Age Of Housing On Hamilton Beach (%)

Year of Construction	Bayside		Lakeside		Average
	Beach Boulevard	Side Streets	Beach Boulevard	Side Streets	
Before 1900	17.7	2.4	13.5	16.3	11.1
1901-1910	12.4	12.8	14.7	28.2	14.5
1911-1920	19.5	28.8	27.0	23.1	25.5
1921-1930	19.5	30.4	12.9	23.1	20.5
1931-1940	10.6	16.8	9.8	5.1	11.6
1941-1950	17.7	5.6	17.8	7.7	13.4
1951-1960	1.8	1.6	.6	0.	1.1
After 1961	.8	1.6	3.7	2.5	2.3
	100.0%	100.0%	100.0%	100.0%	100.0%

Source: City of Hamilton's 1981 Tax Assessment Rolls.

TABLE 27

Value Of Single Family Homes On Hamilton Beach (%)

\$000.00	Bayside		Lakeside		Average
	Beach Boulevard	Side Streets	Beach Boulevard	Side Streets	
5 - 9999	0	0	1.7	0	.5
10-14,999	2.9	2.4	7	11.1	4.8
15-19,999	8.7	24.2	13	27.8	17
20-24,999	23.1	36.3	13	30.6	25.2
25-29,999	30.8	29	20.4	25	26.5
30-34,999	22.1	8.1	22.6	0	15.6
35-39,999	6.7	0	12.2	5.5	5.9
40-44,999	3.8	0	7	0	3.2
45-49,999	.9	0	.9	0	0.5
50-54,999	.9	0	1.7	0	.8
55,000 +	0	0	0	0	0
	100.0%	100.0%	100.0%	100.0%	100.0%

Source: The City of Hamilton's Tax Assessment Rolls for 1981.

TABLE 28

Tenure On Hamilton Beach (%)

Tenure	Bayside		Lakeside		Average
	Beach Boulevard	Side Streets	Beach Boulevard	Side Streets	
Owner Occupied	81	85.7	78.1	82.1	81.3
Tennant Occupied	15.7	9.5	20.7	17.9	16.0
Vacant	3.3	4.8	1.2	0	2.7
	100.0%	100.0%	100.0%	100.0%	100.0%

Source: The City of Hamilton's 1981 Tax Assessment Rolls

TABLE 29

Dwellings On Hamilton Beach By No. Of Units (%)

No. of Units	Bayside		Lakeside		Average
	Beach	Side	Beach	Side	
	Boulevard	Streets	Boulevard	Streets	
1	82.6	92.1	74	89.7	82.9
2	13.2	7.1	14.2	7.7	11.4
3	0	.8	3.6	2.6	1.8
4	4.1	0.	6.5	0.	3.5
5	0	0	.6	0	.2
6	0	0	.6	0	.2
	100.0%	100.0%	100.0%	100.0%	100.0%

Source: The City of Hamilton's 1981 Tax Assessment Rolls.

TABLE 30

Public Open Space In Hamilton-Wentworth Region

Area Municipality	Public Parks	Other Public Open Space	Total Public Open Space	Private Open Space & Recreation	Total Public & Private
Hamilton	1273.6	2084.8	3358.4	142.8	3501.2
Ancaster	130.5	1354.7	1485.2	1110.6	2595.8
Dundas	105.9	1739.7	1845.6	148.0	1993.6
Stoney Creek	127.3	314.5	441.8	337.5	779.3
Flamborough	154.0	4664.2	4818.2	1971.6	6789.8
Glanbrook	48.4	1026.3	1074.7	832.2	1897.9
REGION	1839.7	11184.2	13023.9	4533.7	17557.6

Units: acres
These Figures exclude educational facilities and cemeteries.

Source: The Planning and Development Department of the Regional Municipality of Hamilton-Wentworth, A Substudy of the Regional Official Plan-Recreation Inventory, November 1975, p. 4.

TABLE 31

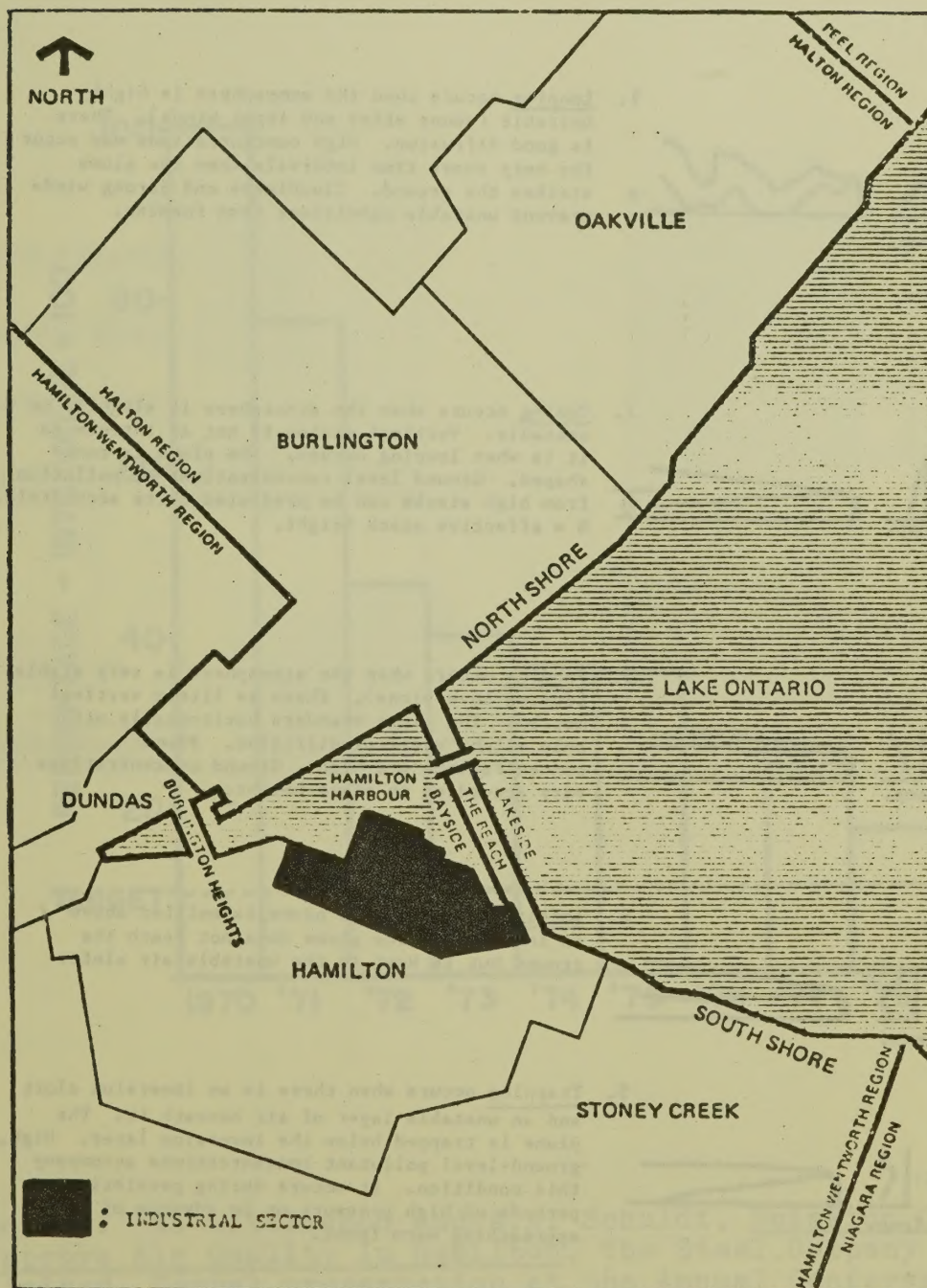
Future Recreational Space For
The Halton-Wentworth Waterfront

PARK TYPE	EXISTING	RECOMMENDED TARGET		CURRENT DEFICIT
		No. of Sites	Length or Area	
Street-End	3	50	NA	47 sites
Creek Mouth	2	13	NA	11 sites
Creek Trail	2700'	13	8,150'	5450'
Promenade	7220'	34	64,050'	56,830'
Community Park	121 ac.	11	336 ac.	215 ac
Regional Park	1481 ac	5	2,489 ac.	1008 ac.

Source: Acres Consulting Services Limited and Project Planning Associates Limited, The Halton-Wentworth Waterfront Study, June 1974, p.116.

FIGURE 1

Map Of Hamilton-Wentworth Region

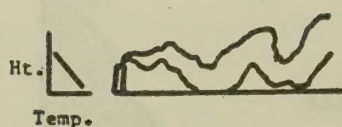


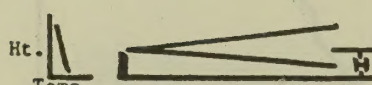
Source: Hamilton Federation of Environmental Groups, Eco-Inventory, An environmental Appraisal of Halton-Wentworth Counties, 1971.

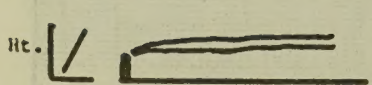
FIGURE 2

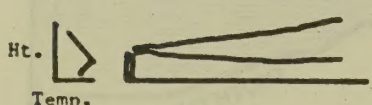
Behavior Of Smoke Plumes

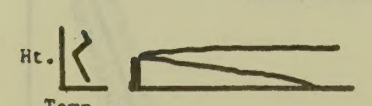
1. Looping occurs when the atmosphere is highly unstable (sunny skies and light winds). There is good diffusion. High concentrations may occur for very short time intervals when the plume strikes the ground. Cloudiness and strong winds prevent unstable conditions from forming.


2. Coning occurs when the atmosphere is slightly unstable. Vertical mixing is not as intense as it is when looping occurs. The plume is cone-shaped. Ground level concentrations of pollution from high stacks can be predicted quite accurately. H = effective stack height.


3. Fanning occurs when the atmosphere is very stable (during inversions). There is little vertical motion. The plume meanders horizontally with only slight vertical diffusion. Plume concentrations are high. Ground concentrations vary according to stack height.


4. Lofting occurs when a plume is emitted above an inversion. The plume does not reach the ground but is kept in the unstable air aloft.

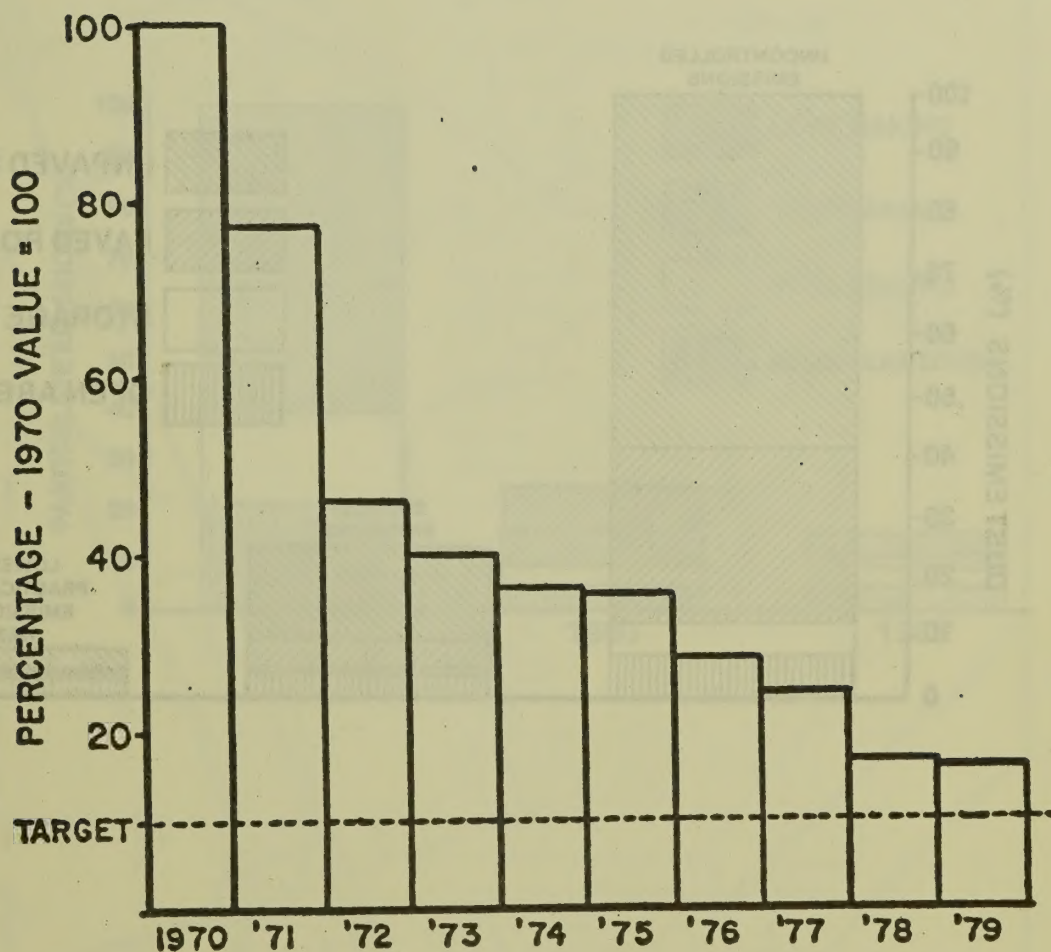

5. Trapping occurs when there is an inversion aloft and an unstable layer of air beneath it. The plume is trapped below the inversion layer. High, ground-level pollutant concentrations accompany this condition. It occurs during persisting periods of high pressure or in advance of an approaching warm front.



Source: L. Shenfeld, Ontario Department of Energy and Resources Management, Meteorological Aspects of Air Pollution Control, 1973, p. 8.

FIGURE 3

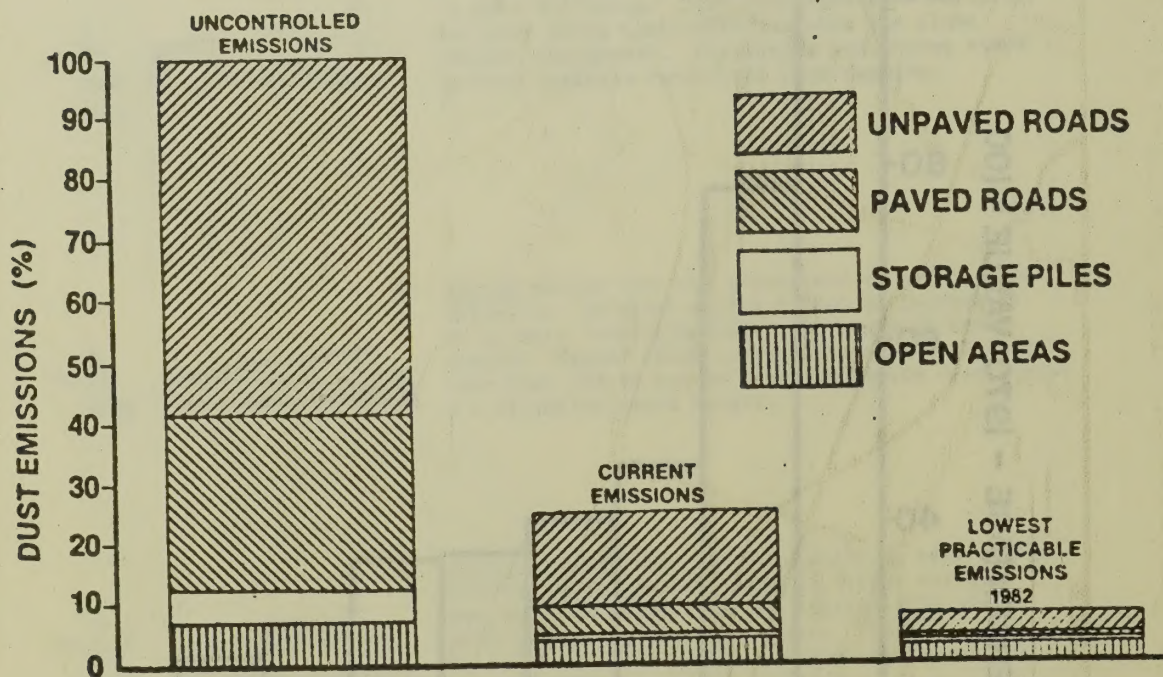
Reduction Of Hilton Works Particulate Emissions



Source: R. Littlewood and A.A. Schuldt, Emission Controls Improve Air Quality In Hamilton. The Steel Company of Canada Limited, Verbal presentation at the Annual Conference of the Air Pollution Control Association, Ontario Section, Toronto, May, 1978.

FIGURE 4

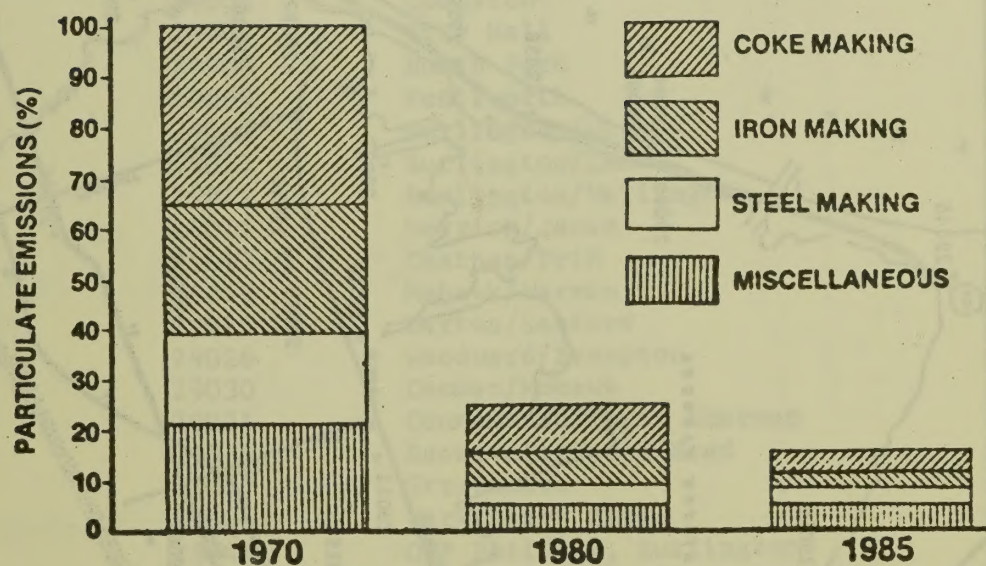
Reduction Of Dofasco Yard And Road Dust Emissions



Source: M.S. Greenfield, Air Pollution Control At Dofasco, Environment '80 Conference, 14-15 November 1980, p. 23.

FIGURE 5

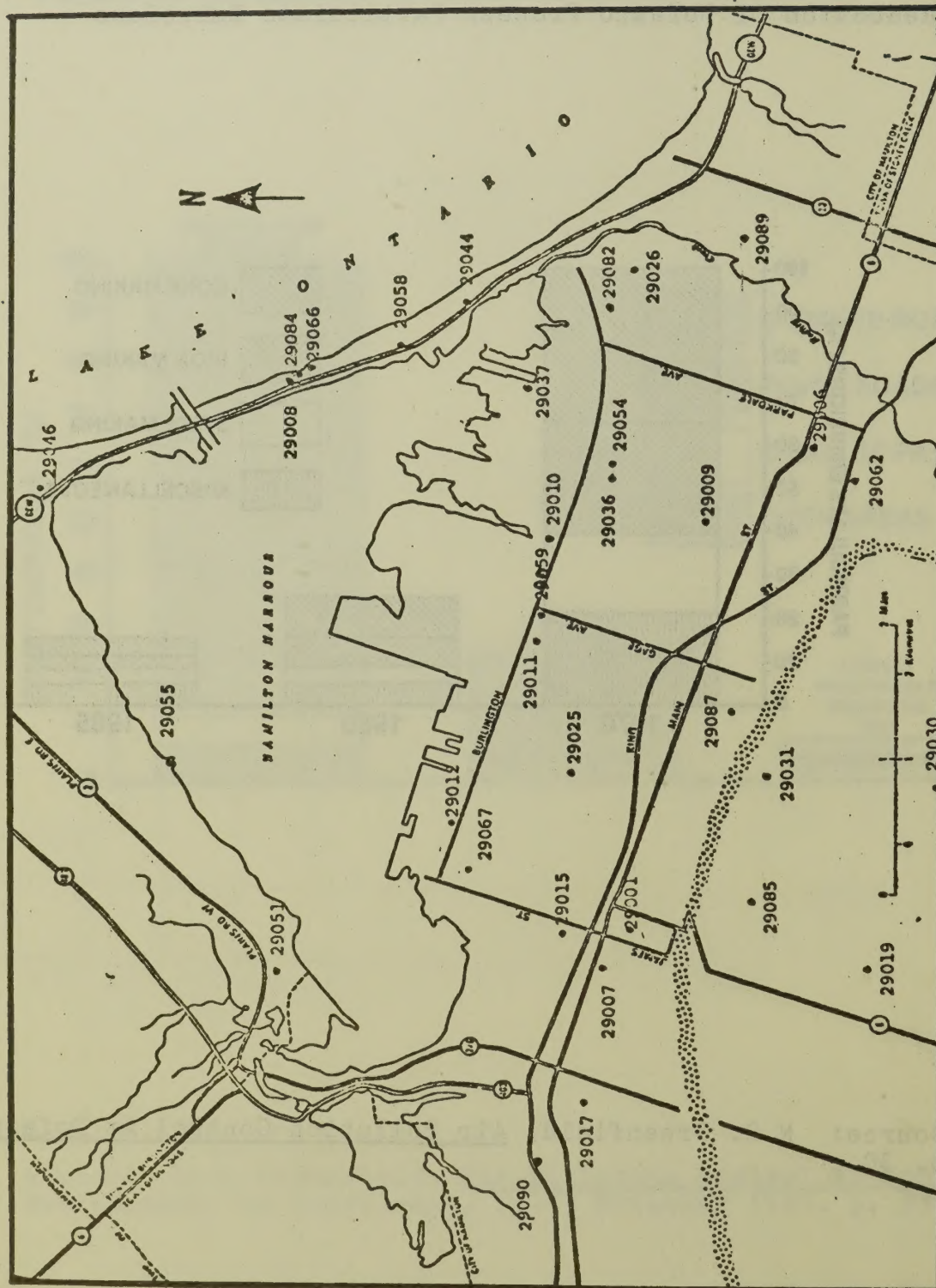
Reduction Of Dofasco Process Particulate Emissions



Source: M.S. Greenfield, Air Pollution Control At Dofasco, p. 30.

FIGURE 6a

Hamilton Air Monitoring Network



Source: Ontario Ministry of the Environment, 1980 Hamilton Air Quality, July 1981, p. 17

FIGURE 6b

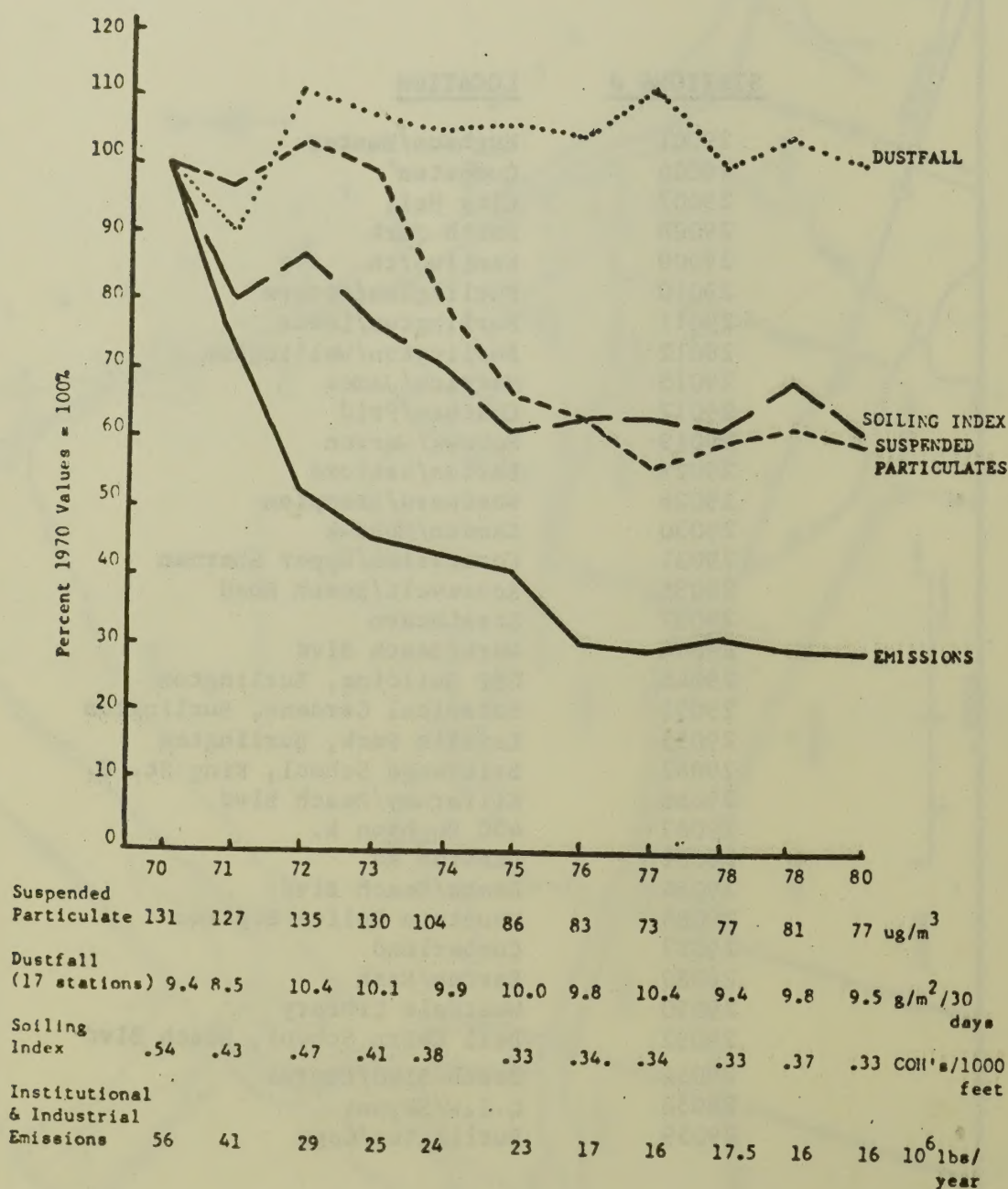
Location Of Monitoring Stations

<u>STATIONS #</u>	<u>LOCATION</u>
29001	Hughson/Hunter
29006	Quehston
29007	City Hall
29008	North Park
29009	Kenilworth
29010	Burlington/Ottawa
29011	Burlington/Leeds
29012	Burlington/Wellington
29015	Merrick/James
29017	Chathan/Frid
29019	Mohawk/Warren
29025	Barton/Sanford
29026	Woodward/Brampton
29030	Camden/Mohawk
29031	Concession/Upper Sherman
29036	Roosevelt/Beach Road
29037	Strathearn
29044	Wark/Beach Blvd
29046	OPP Building, Burlington
29051	Botanical Gardens, Burlington
29055	LaSalle Park, Burlington
29062	Briarwood School, King St. E.
29066	Killarney/Beach Blvd
29067	450 Hughson N.
29082	Leaside Rd
29084	Rembe/Beach Blvd
29085	Mountain Police Station
29087	Cumberland
29089	Barton/Nash
29090	Westdale Library
29092	Bell Cairn School, Beach Blvd
29054	Beach Blvd/Conrad
29058	Q.E.W/Skyway
29059	Burlington/Gage

Source: see Figure 6a

FIGURE 7

Particulate Trends Versus Estimated Emissions



Source: Ontario Ministry of the Environment, 1980 Hamilton Air Quality, July 1981, p. 20.

FIGURE 8

Dustfall Versus Proximity To Industrial Sector
(1981 Data)

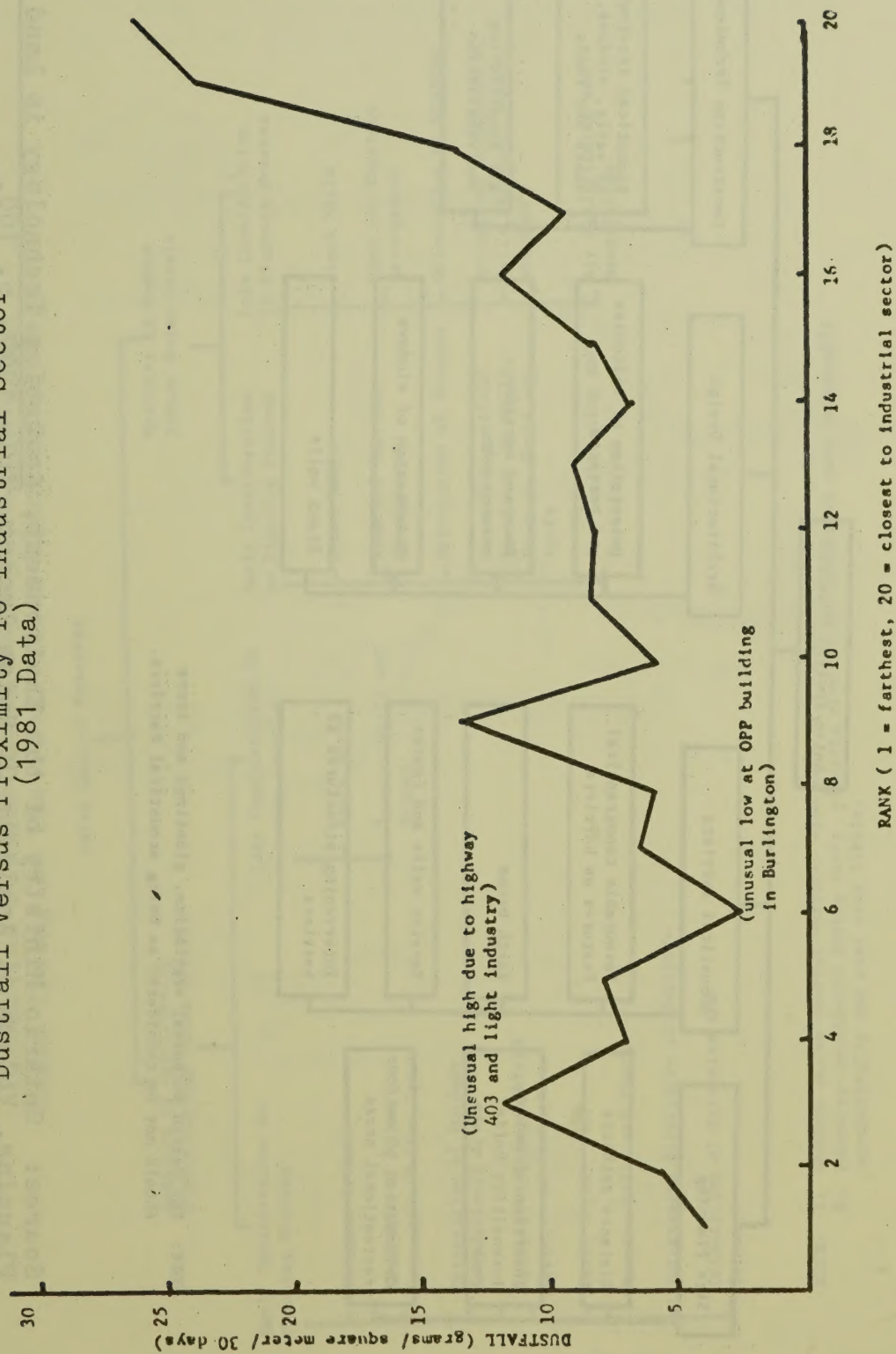
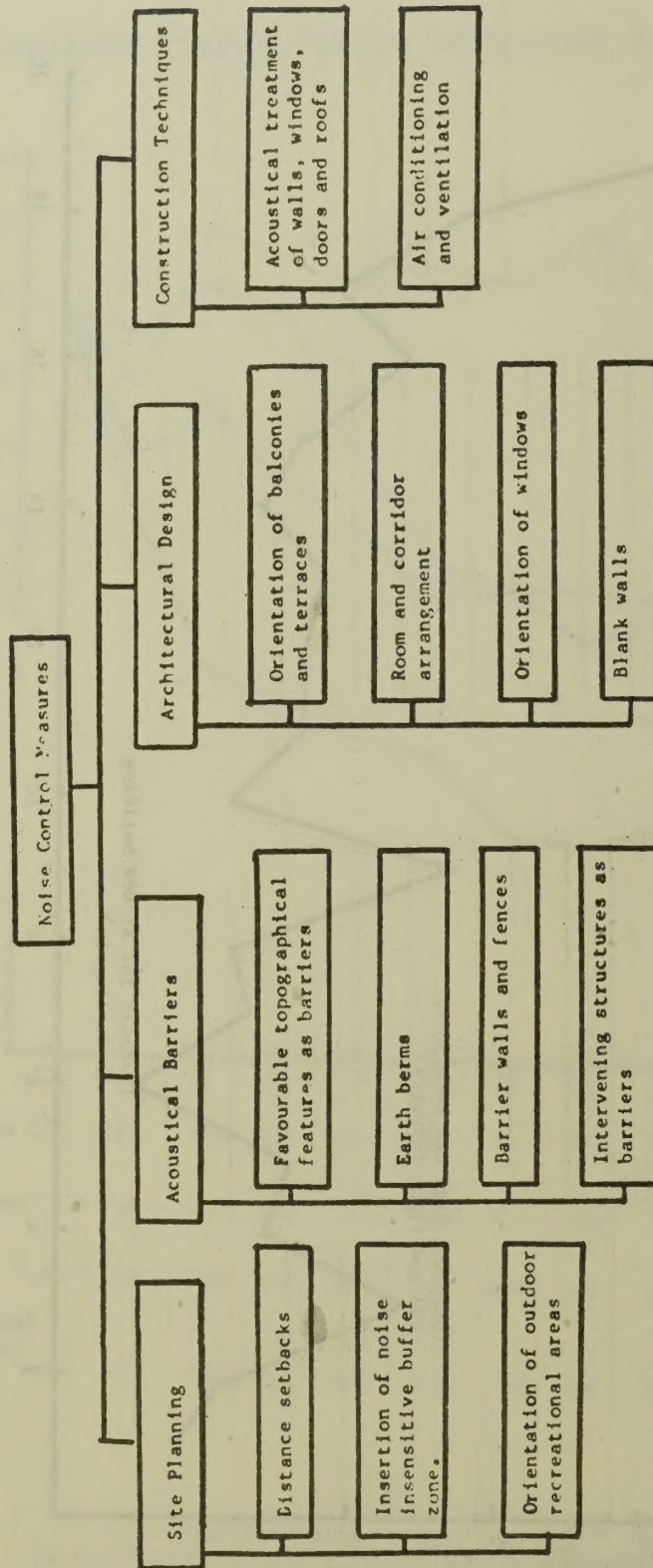


FIGURE 9

Noise Control Measures Applicable To Design Of New Housing

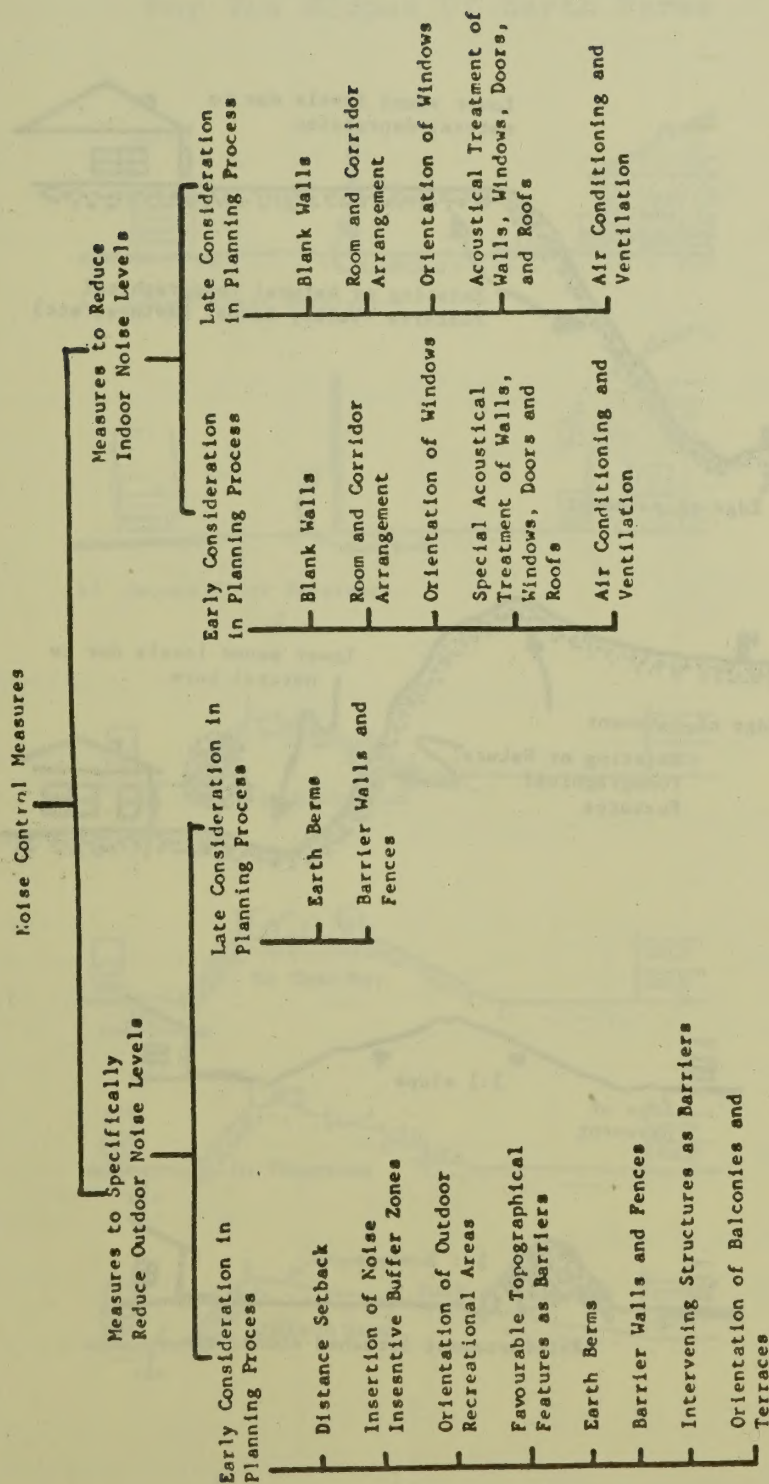


NOTE: For design purposes, vegetation, plantings and trees should not be considered as being acoustical barriers.

Source: Ontario Ministry of the Environment, Acoustics Technology in Land Use Planning, Volume 1, Analysis Of Noise Impact, July 1977, p. 100.

FIGURE 10

Indoor And Outdoor Noise Control Measures And Their Timing In The Subdivision Planning Process

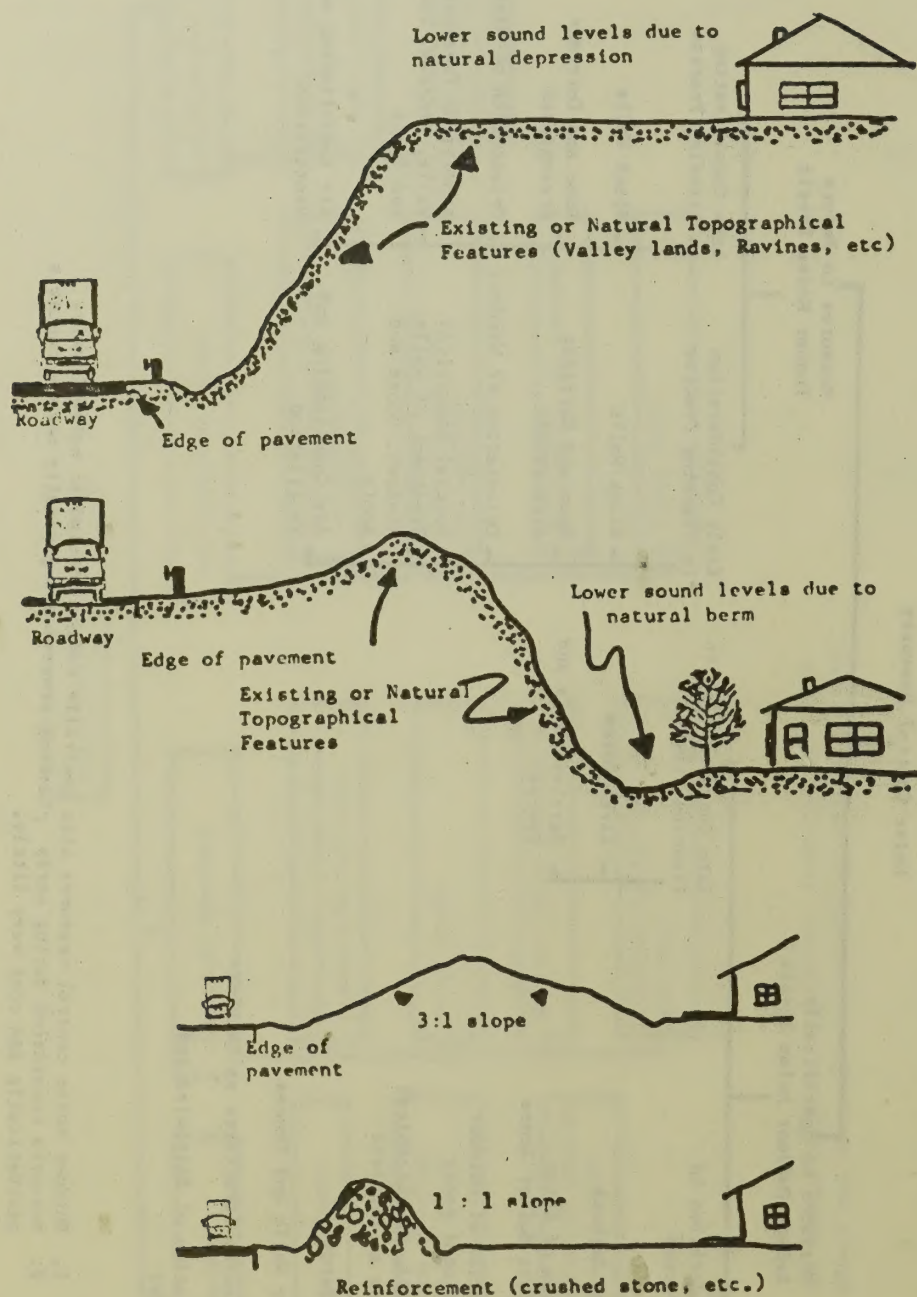


- NOTE:
1. Outdoor noise control measures also generally reduce the indoor noise levels.
 2. Measures considered during early planning process are generally more acceptable aesthetically and cost very little.

Source: Ontario Ministry of the Environment, Acoustics Technology in Land Use Planning, Volume 1, Analysis of Noise Impact, July 1977, p. 98

FIGURE 11

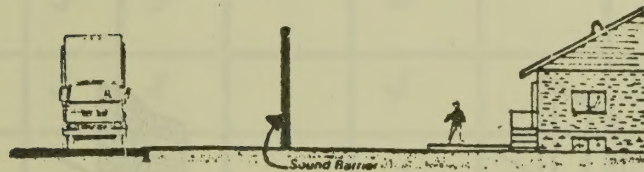
Profile Of Various Berms



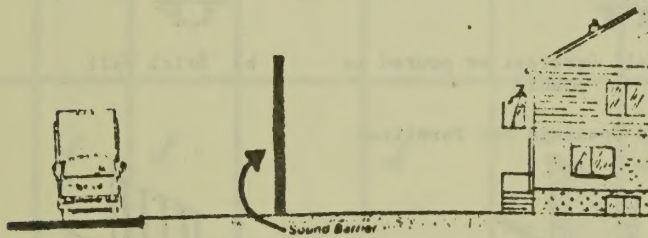
Source: Ontario Ministry of the Environment, Acoustics Technology in Land Use Planning, Volume 1, Analysis of Noise Impact, July 1977, p. 116.

FIGURE 12

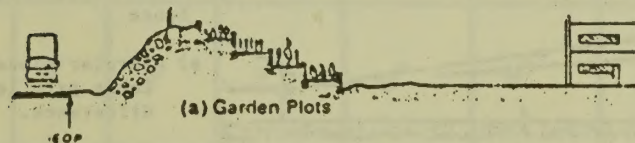
Sound Barriers and Various Applications For
For The Slopes Of Earth Berms



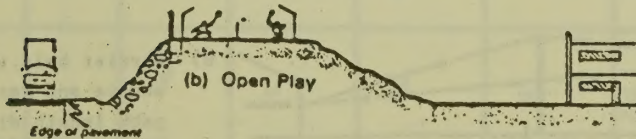
a) Ground Floor Receiver



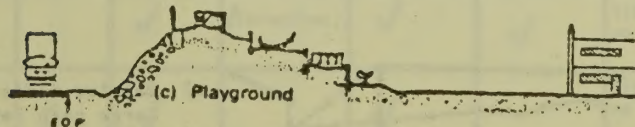
b) Second Floor Receiver



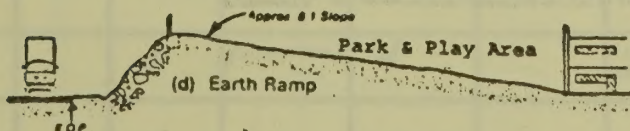
(a) Garden Plots



(b) Open Play



(c) Playground

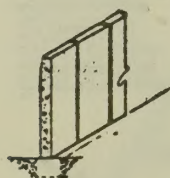


(d) Earth Ramp

Source: Ontario Ministry of the Environment, Acoustics Technology in Land Use Planning, Volume 1, Analysis of Noise Impact, July 1977, pp. 114, 118.

FIGURE 13

Acoustical Barrier Walls And Fences And
Their Locations With Respect To Receiver And Roadway

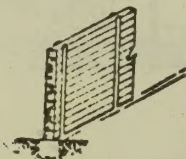


a) Concrete Wall (precast or poured in place)

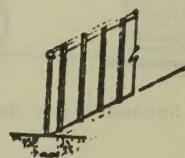


b) Brick Wall

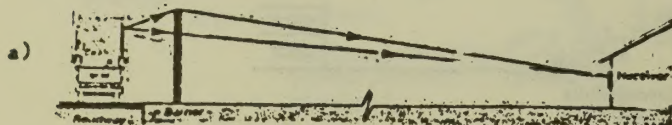
NOTE: Gaps and Openings Not Permitted



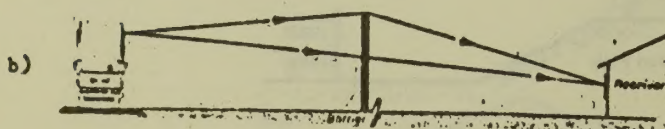
c) Timber Wall



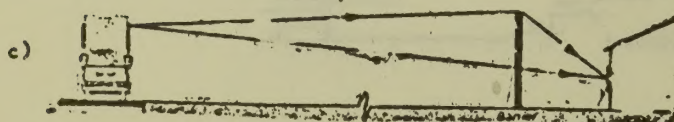
d) Sheet Metal or Solid Wood Fence



a) Barrier close to source. Large path length difference. Recommended.



b) Barrier half way between source and receiver. Small path length difference. Not recommended.



c) Barrier close to receiver. Large path length difference. Recommended.

Source: Ontario Ministry of the Environment, Acoustics Technology in Land Use Planning, Volume 1, Analysis of Noise Impact, July 1977, pp. 114, 118.

FIGURE 14
A Check List Of The Noise Control
Measures For New Housing

Measure	Application		Possible		Recommended		Remarks	
	Control Indoor Levels	Control Outdoor Levels	Timing of Application in Subdivision Planning Process		Timing of Application in Subdivision Planning Process		Cost Considerations	Advantages/Limitations
			Early	Late	Early	Late		
SITE PLANNING								
1. Distance Set-back		✓	✓		✓		High	Impactical for urban areas
2. Noise Sensitive Buffer Zones		✓	✓		✓		Slight to moderate	Moderately effective, wide range of possible application
3. Orientation of Outdoor Recreational Areas (located on ground levels)		✓	✓		✓		Very little or no cost	Quite effective, highly recommended
ACOUSTICAL BARRIERS								
1. Favourable Topographical Features as Barriers		✓	✓		✓		Little or no cost	Quite effective
2. Earth Berms		✓	✓	(sometimes) ✓	✓		moderate to high	Problems with visibility, maintenance, snow removal etc. Should be considered if spare earth is available at the site, aesthetically less acceptable
3. Barrier Walls and Fences		✓	✓	✓	✓	✓	High	Maintenance and visibility problem. Cuts down on head-light glare, provides excellent and sharp physical separation.
4. Intervening Structures as Barriers		✓	✓		✓		Very little or no cost	Very effective, highly recommended
ARCHITECTURAL DESIGN								
1. Blank Walls	✓		✓	✓	✓	✓	little or no cost	Places severe restrictions on conventional designs and can pose problems in providing adequate lighting and ventilation
2. Room and Corridor Arrangement	✓		✓	(sometimes) ✓	✓	✓	little or no cost	very effective for high noise level exposures
3. Placement of Balconies and Terraces (located at higher elevations)		✓	✓		✓		little or no cost	very effective, highly recommended
4. Orientation of Windows	✓		✓	(sometimes) ✓	✓		little or no cost	very effective, highly recommended
CONSTRUCTION TECHNIQUES								
1. Special Acoustical Treatment	✓		✓	✓	✓	✓	moderate to high cost	effective
2. Air Conditioning and Ventilation	✓		✓	✓	✓	✓	high cost	should be used as a last resort, discouraged due to energy conservation considerations

Source: Ontario Ministry of the Environment, Acoustics Technology In Land Use Planning, Volume 1, Analysis of Noise Impact, July 1977, Table V2-B3.

FIGURE 15

Common Noise Levels And Typical Reactions

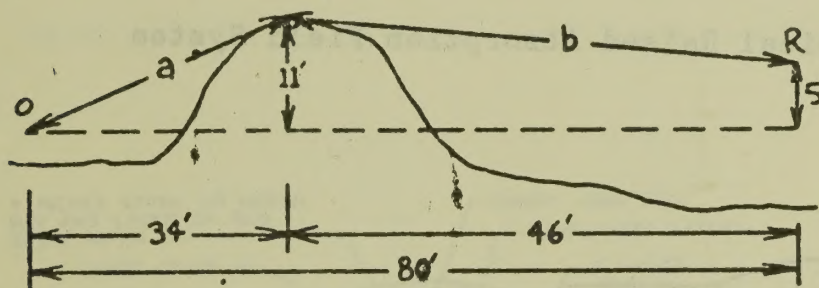
Sound Source	Noise Level	Apparent Loudness	Typical Reaction	CMHC requirements		
				Categories	dB	Maximum Acceptable Level
Military Jet	135		Painfully loud	Unacceptable		
	130	Sixty-four times as loud	Limit amplified speech			
Jet takeoff at 200'	120	Thirty-two times as loud				
	110	Sixteen times as loud	Maximum vocal effort			
Jet takeoff at 2,000'	100	Eight times as loud				
Flight Train at 50'	95			Unacceptable without adequate sound insulation		
Heavy truck at 50'	90	Four times as loud	Very annoying Hearing damage (8 hours)			
Busy city street	80	Twice as loud	Annoying			
Highway traffic at 50'	70	Base reference	Telephone use difficult		75	
Light car traffic at 50'	60	Half as loud	Intrusive			
Noisy office	50	Quarter as loud	Speech interference	Normally acceptable	55	Outdoor recreation
					45	kitchens
Public Library	40	Eighth as loud	Quiet		45	bathrooms
					40	living
Soft whisper at 15'	30	Sixteenth as loud	Very quiet		35	dining
				Acceptable		Bedrooms
	10	Sixty-fourth as loud	Just audible			
Threshold of hearing	0					

NOTE: The minimum difference in noise level that is noticeable to the human listener is 3 dB. A 10 dB increase doubles the apparent loudness while a 10 dB decrease halves the apparent loudness.

FIGURE 16

Calculation Sheet For Barrier Attenuation

Use of a berm as a barrier



Approximate source

to receiver distance: 50 ft. _____ (use Table 3.6.1) ☒ Barrier closer to source
 70 ft. ☒ (use Table 3.6.2) (Use the left side of
 100 ft. _____ (use Table 3.6.3) table)
 140 ft. _____ (use Table 3.6.4)
 200 ft. _____ (use Table 3.6.5) Barrier closer to
 400 ft. _____ (use Table 3.6.6) receiver (Use the right
 800 ft. _____ (use Table 3.6.7) side of table)

Barrier to source/receiver (ft.)

Actual
distance

34

Source height relative to receiver

S' below

Barrier height relative to source
or receiver (ft.)

11

Barrier attenuation (dB)

Barrier attenuation averaged for each case (dB)

Attenuation for barrier of infinite length (dB)

Values found in table

35

Same el.

10' below

11

11

14

10

14

10

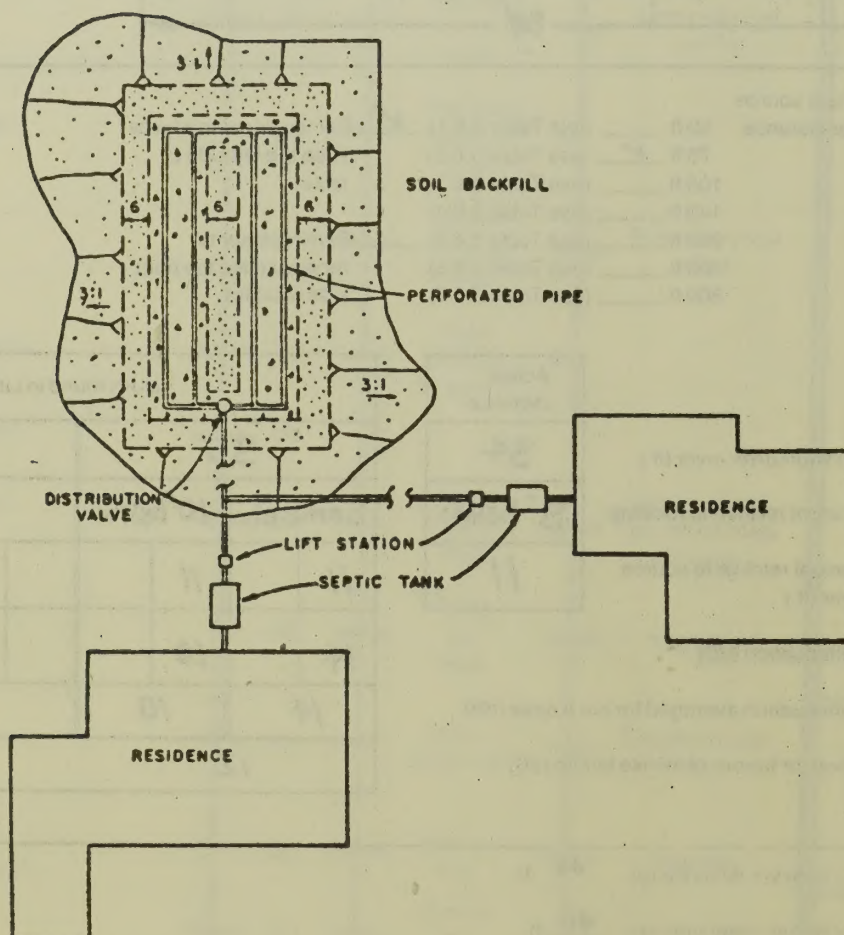
12

Barrier to receiver distance (g) 46 ft.Length of barrier segment (u) = 40 ft.Length of barrier segment (v) 460 ft.Barrier length ratios u/g .9 v/g 10From Table 3.7 effective barrier length ratio w = 15From Table 3.8 the barrier attenuation for a finite barrier = 6 dB

Source, Canada Mortgage and Housing Corporation, Road
and Rail Noise, NHA 5156-12/77, p. 78.

FIGURE 17

Typical Raised Absorption Field System



Source: N.I. McClelland, ed., Individual Onsite Wastewater Systems: Proceedings of the Fifth National Conference 1978 (Ann Arbor: Ann Arbor Science Publishers, 1979), p. 104, N.I. McClelland, ed., Proceedings of the Sixth National Conference 1979, p. 125.

FIGURE 17 (cont)

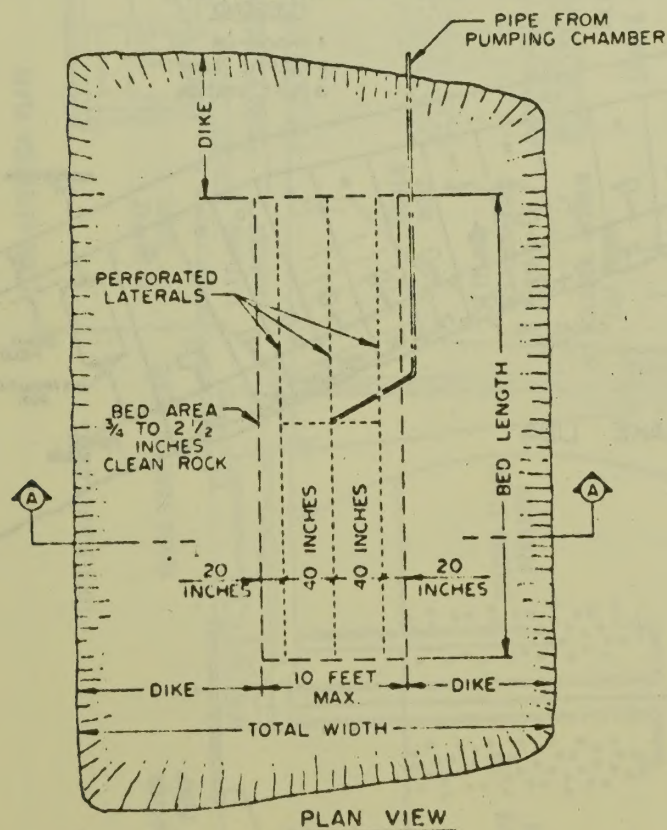
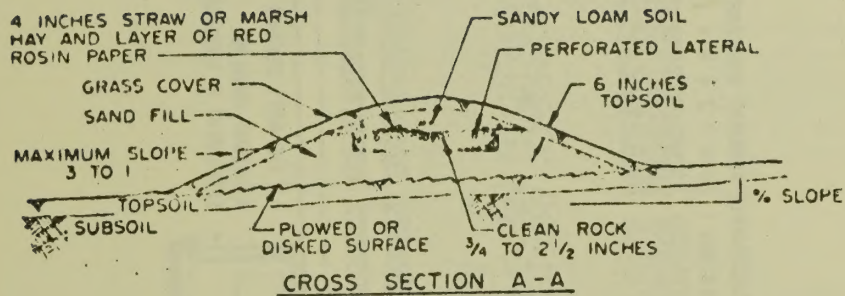
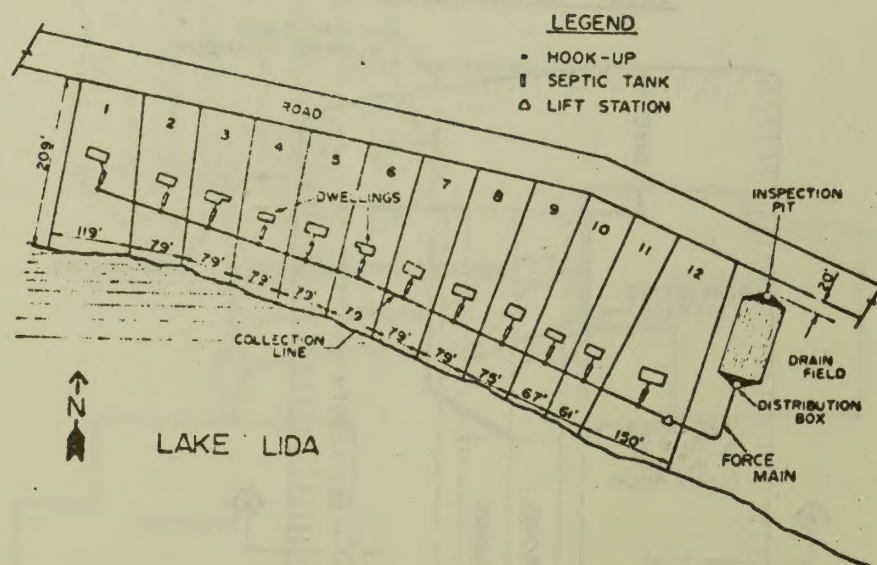


FIGURE 18

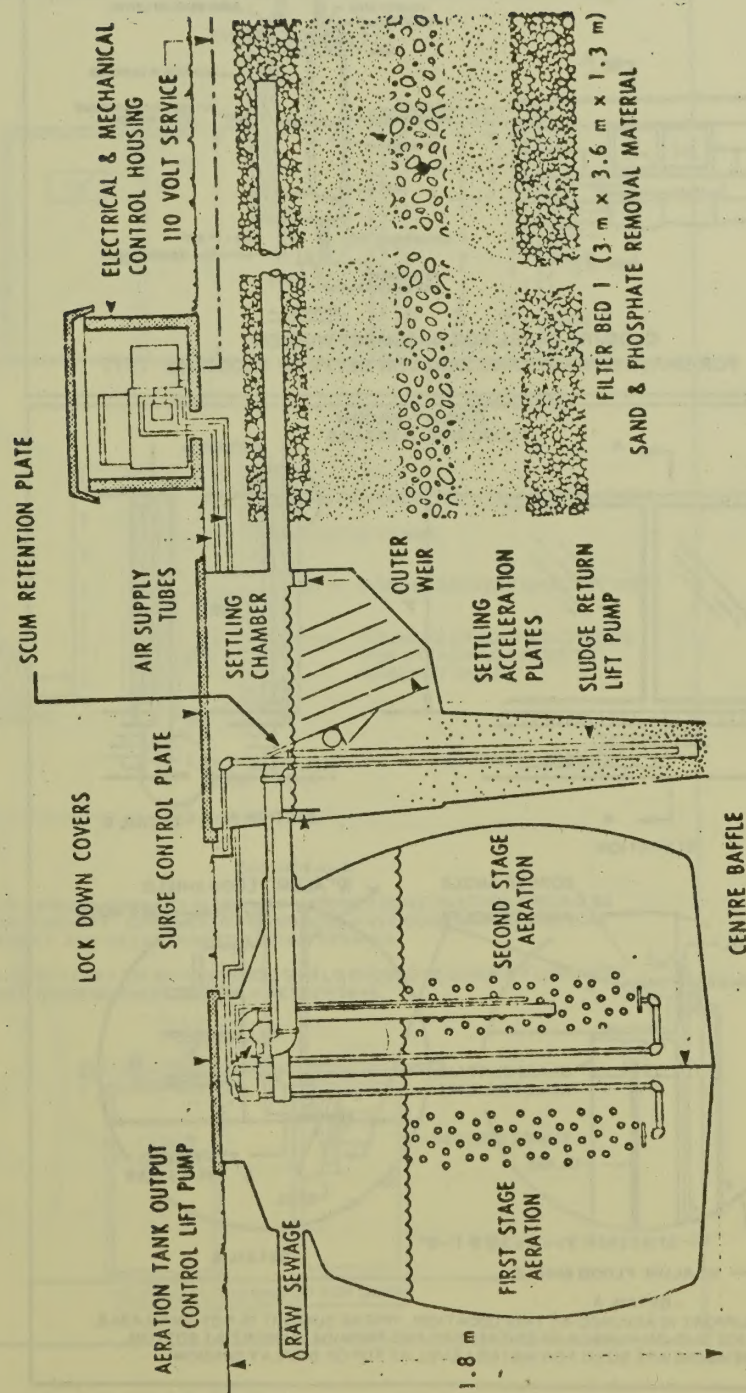
Typical Community Raised Absorption Field System



Source: N.I. McClelland, ed., Individual Onsite Wastewater Systems: Proceedings of the Sixth National Conference 1979, p. 298.

FIGURE 19

An Aerobic Tank System



Source: Environment Canada, Small Wastewater Systems, p. 38.

FIGURE 20

The Closure And Seal Method Of Floodproofing

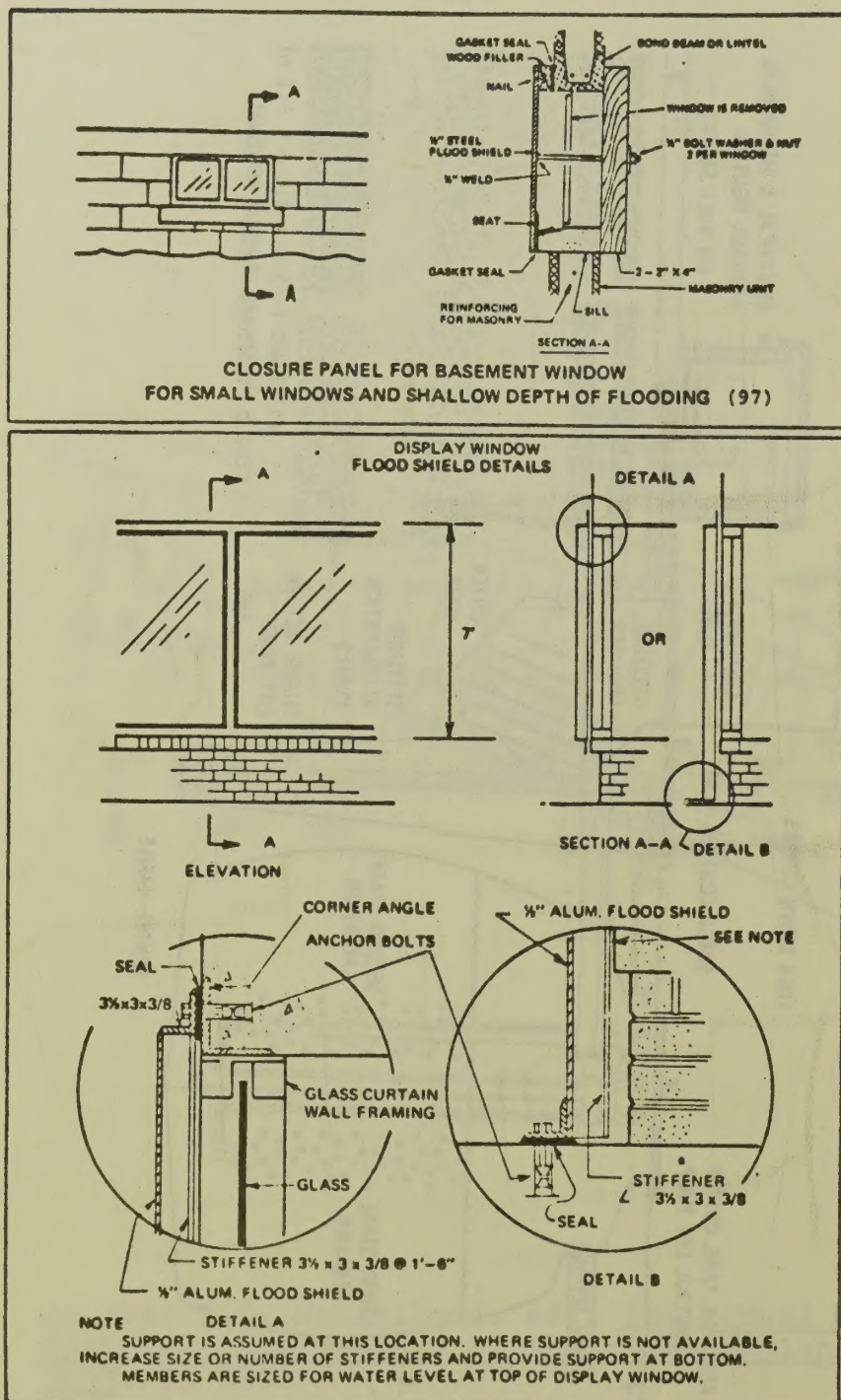
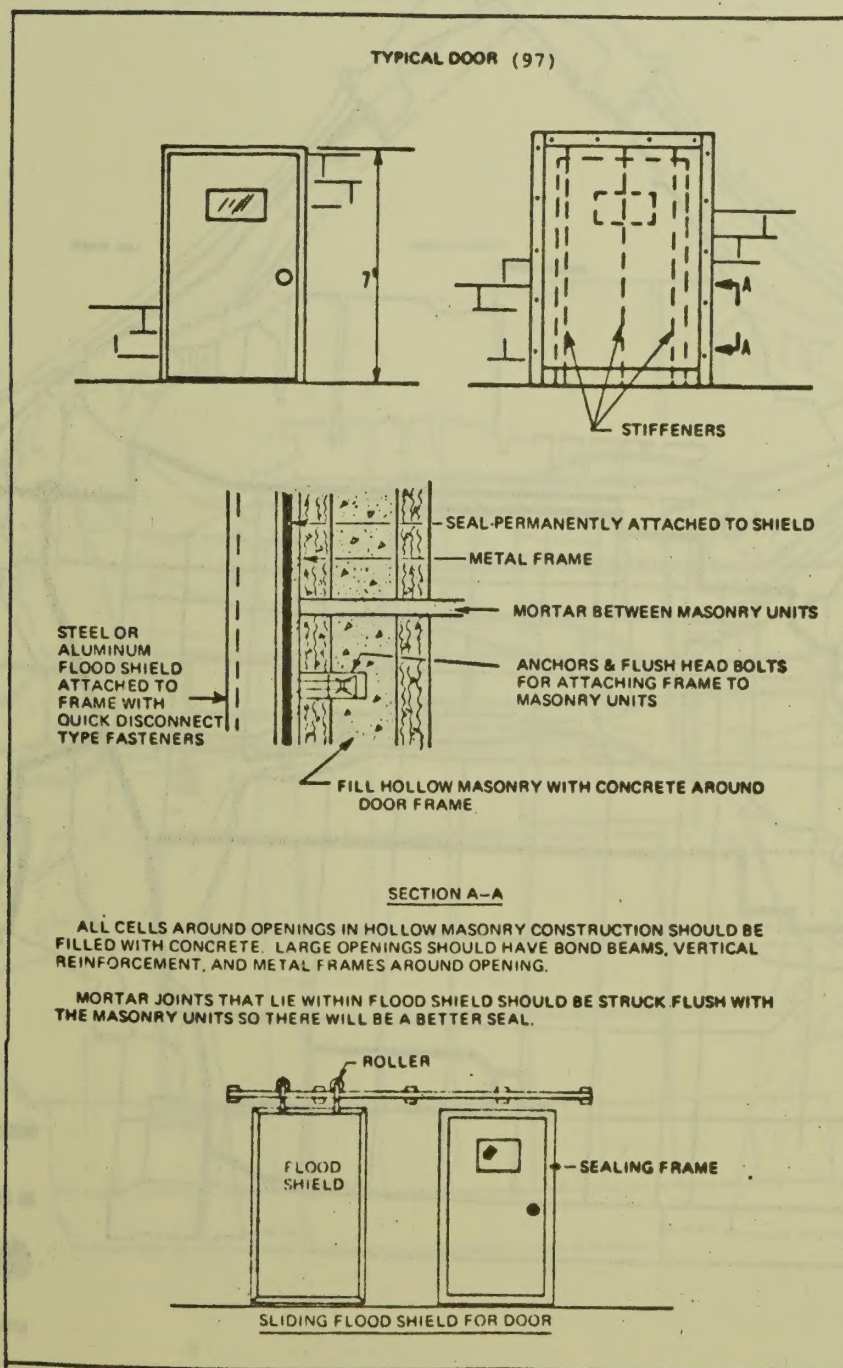


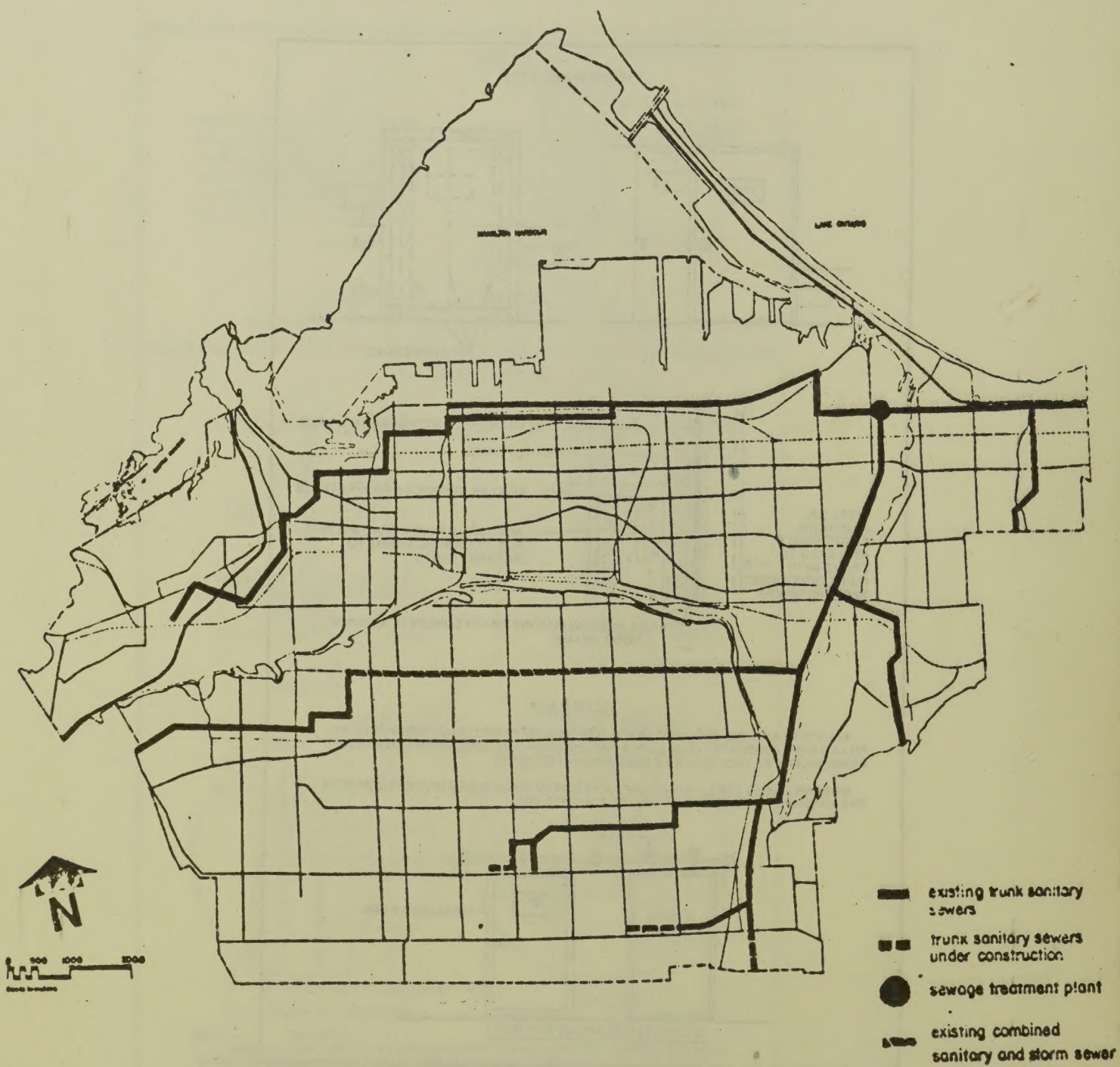
FIGURE 20 (cont)



Source: Department of Fisheries and Environment Canada, Flood Proofing: A Component of Flood Damage Reduction, (Toronto: James Mac Laren Ltd., 1978), pp. 3-4 to 3-5.

FIGURE 21

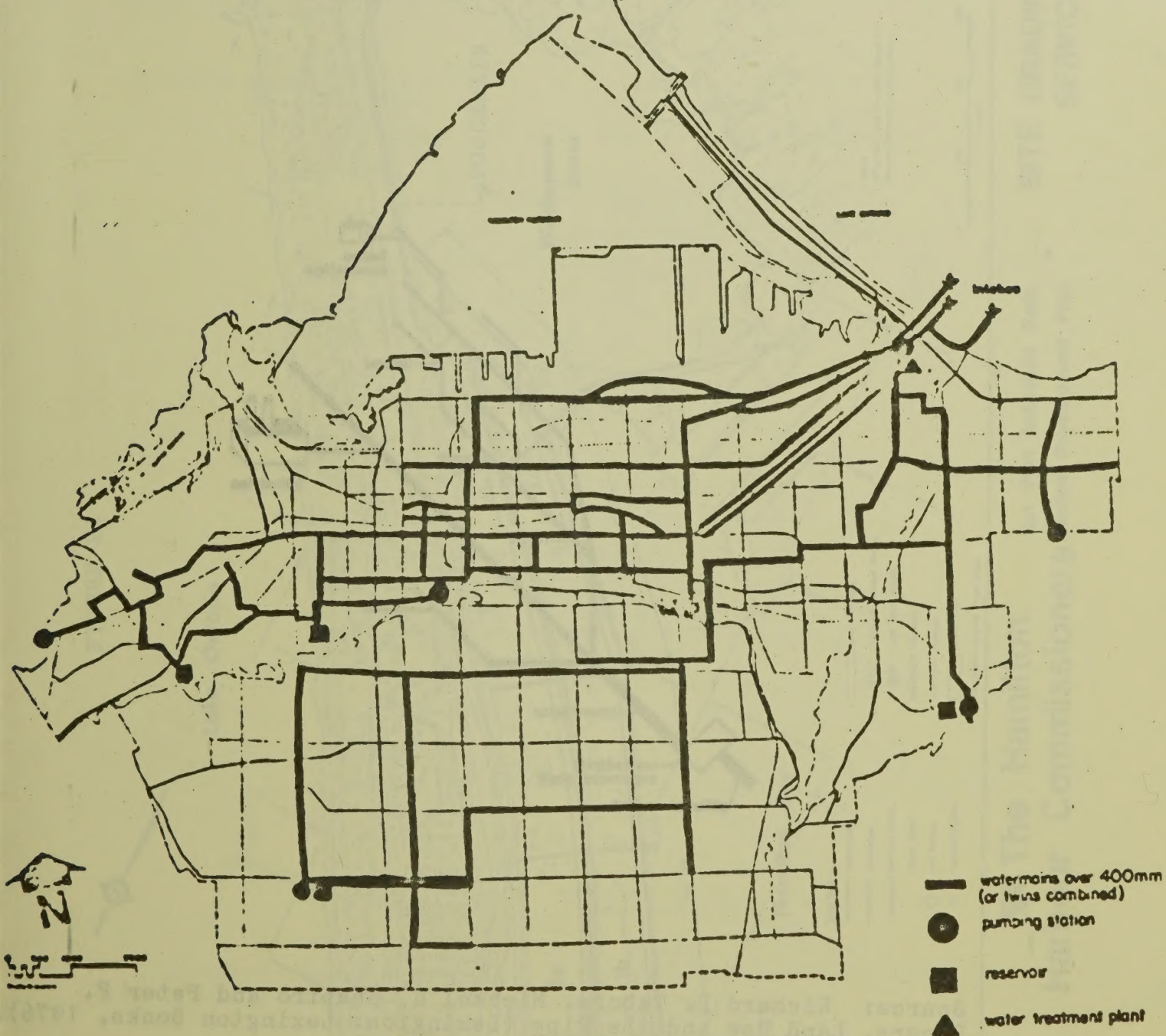
Trunk Sewer Disposal System



Source: Regional Municipality of Hamilton-Wentworth,
Information Hamilton '81, Planning and Development
 Department.

FIGURE 22

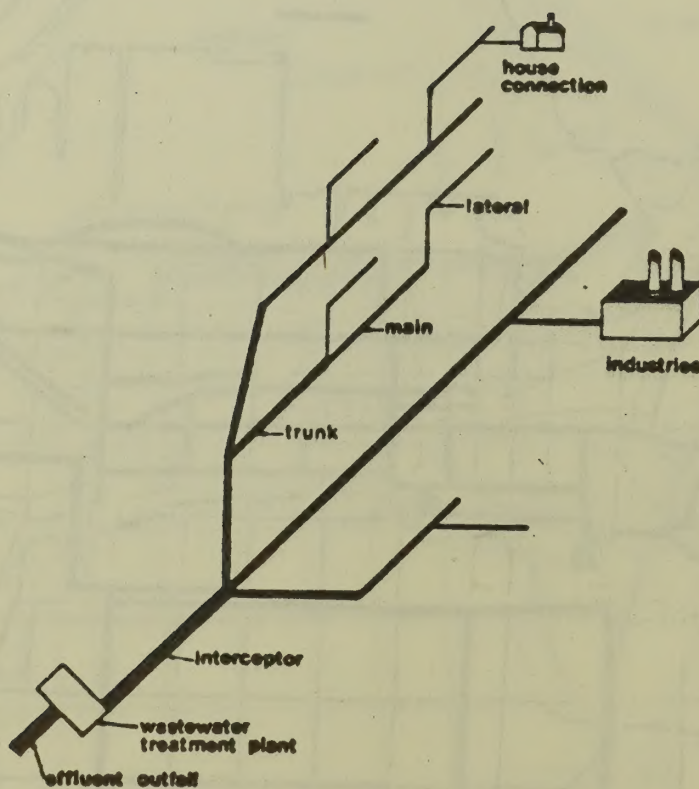
Water Distribution System



Source: Regional Municipality of Hamilton-Wentworth, Information Hamilton '81.

FIGURE 23

Schematic Diagram Of Sewerage Systems



Source: Richard D. Tabors, Michael H. Shapiro and Peter P. Rogers, Land Use and the Pipe (Lexington: Lexington Books, 1976), p. 14.

FIGURE 25

Typical Grinder Pump Onlot Facilities

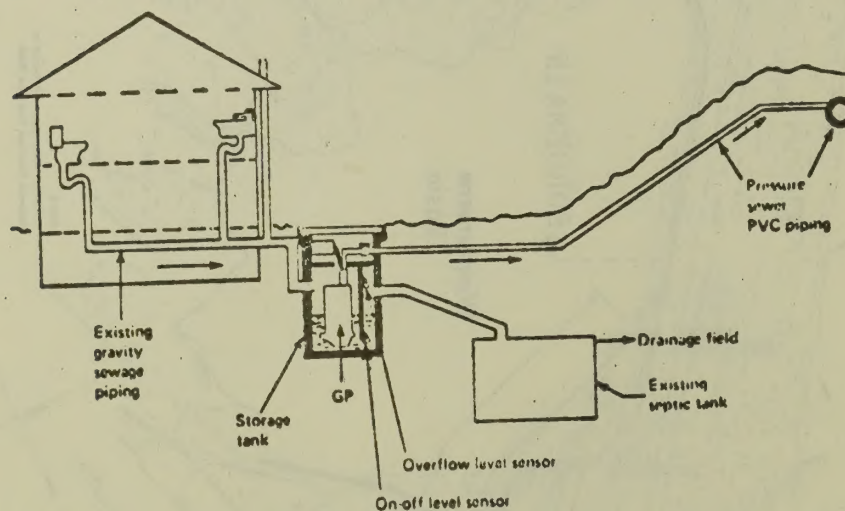
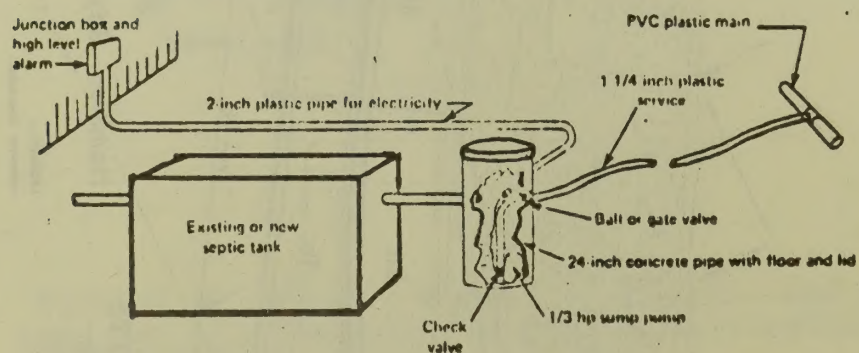


FIGURE 26

Typical STEP System Onlot Facilities



Source: N.I. McClelland, Individual Onsite Wastewater Systems,
(Ann Arbor: Ann Arbor Science Publishers, 1979), p. 125.

FIGURE 27

Cost Estimate For GP System Versus STEP System

Capital cost for installing pressure sewers for 38 single home units

GRINDER PUMP INSTALLATION:

\$324.10 per home per year

or

\$ 27.01	per home per month	
+ \$ 5.07	per home per month	(amortized capital cost)

\$ 32.08 per home per month

STEP SYSTEM INSTALLATION:

\$206.64 per home per year

or

\$ 17.22	per home per month	
+ \$ 5.07	per home per month	(amortized capital cost)

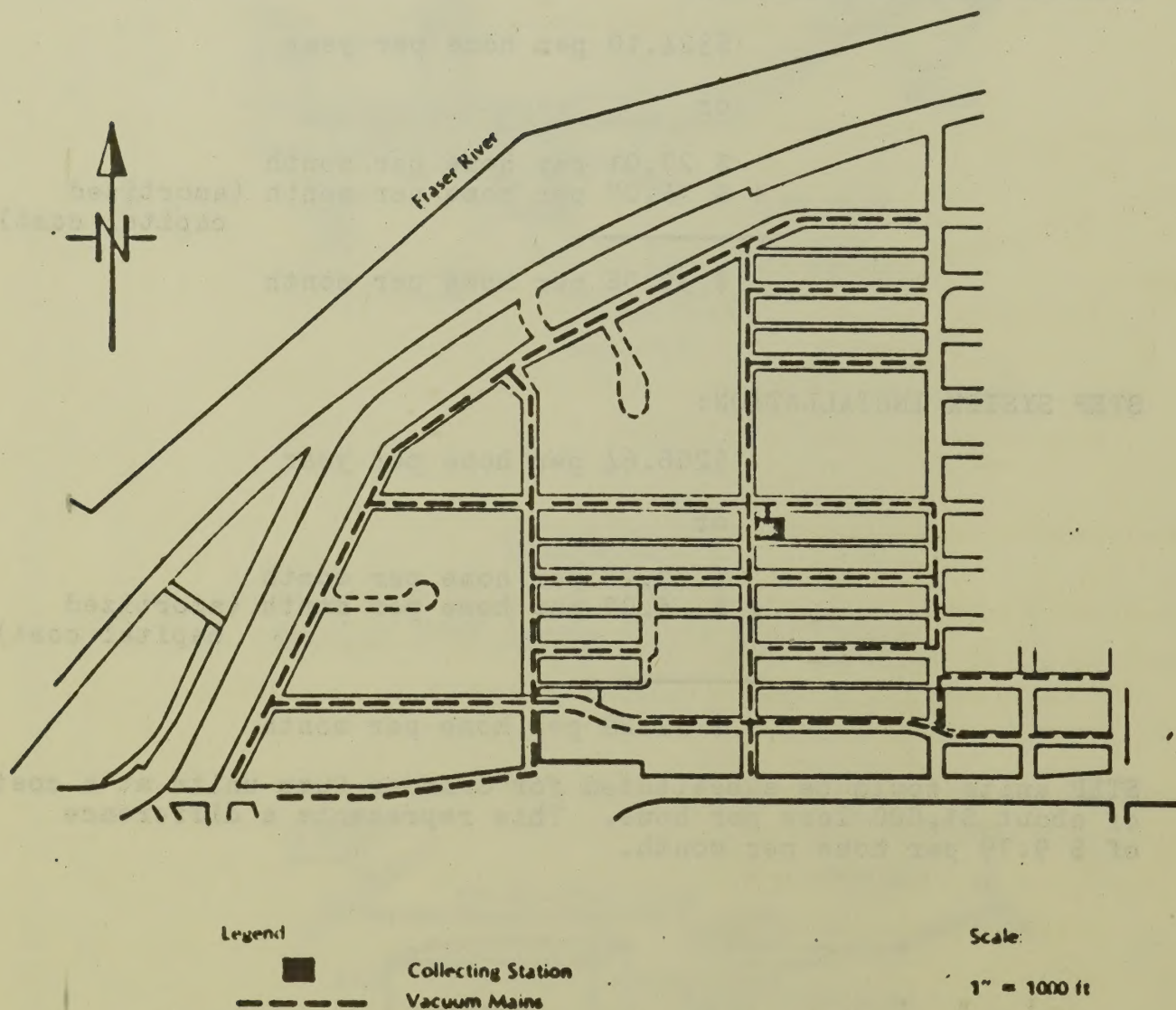
\$ 22.29 per home per month

STEP units could be substituted for Grinder Pump units at a cost of about \$1,000 less per home. This represents a difference of \$ 9.79 per home per month.

Source: Environment Canada, Small Wastewater Systems, 1978, p. 219.

FIGURE 28

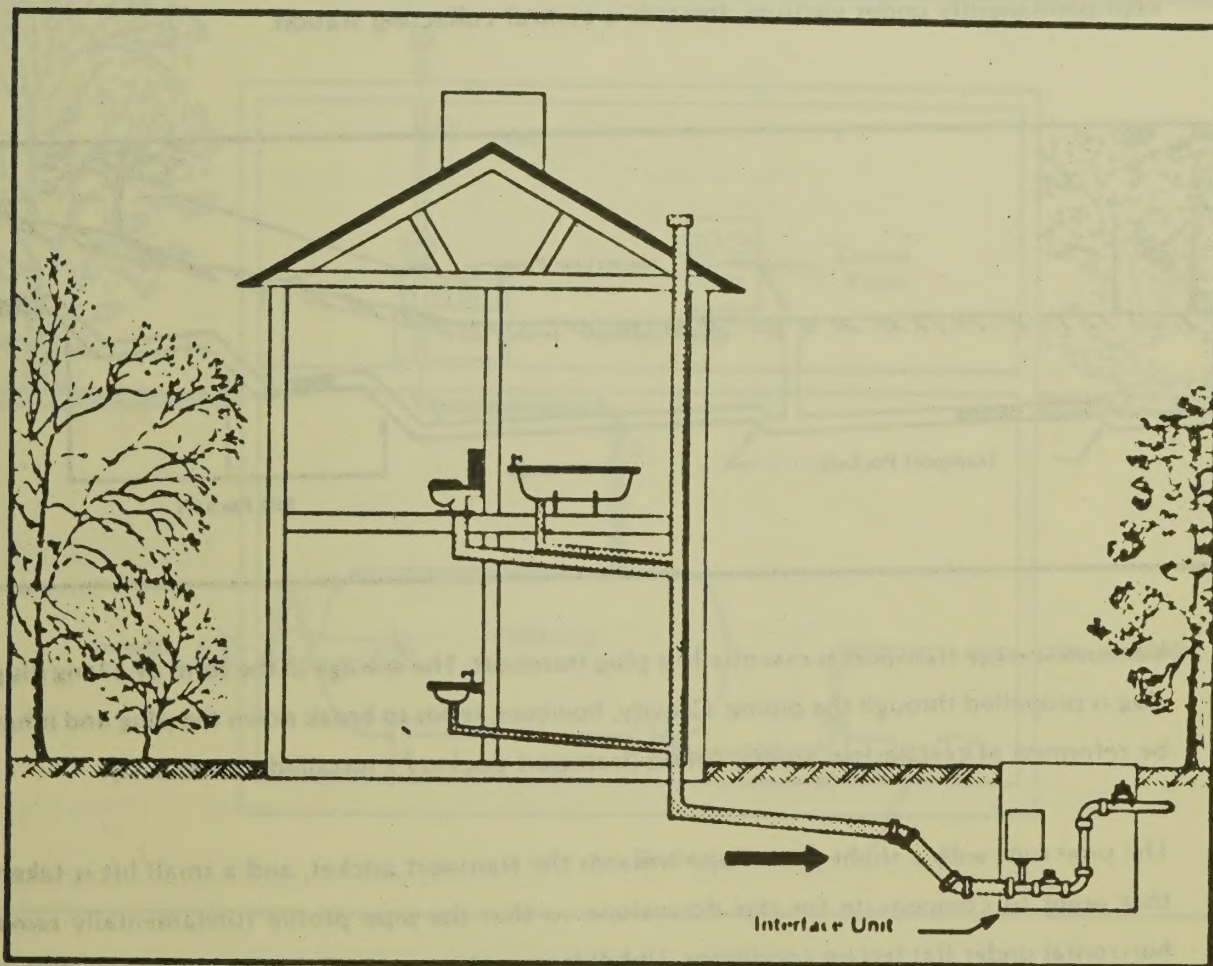
The ON-LINE System- Typical Subdivision Of 500 Homes
With One Central Collecting Station



Source: Vacusan Municipal Systems, Vacuum Sewer Design Manual
The ON-LINE System, p. 3.

FIGURE 29
The Interface Unit

At each source of sewage entering the vacuum system, an interface unit is installed between the gravity pipe and the vacuum service connection, allowing sewage into the vacuum main on demand.



The completely automatic interface unit is self-powered using vacuum available from the piping network without any electrical supply required.

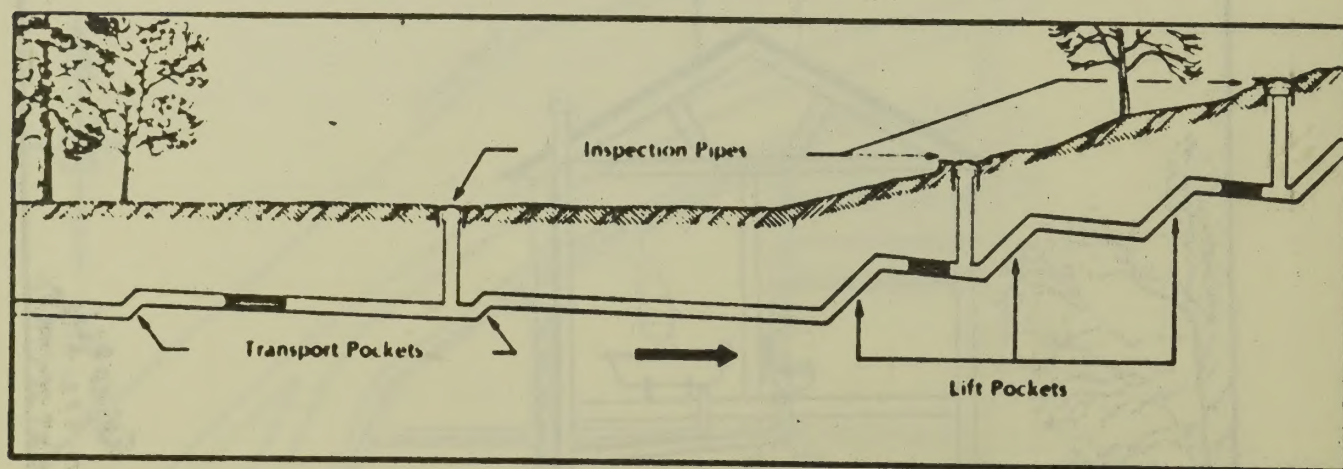
The interface unit has two major components - an activator and a discharge valve. Sewage is interfaced into the vacuum main in predetermined volumes followed by air. This ensures that the discharge valve closes on air and not on sewage, and helps to increase transport velocity and improve lift capability in the piping network.

Source: Vacusan Municipal Systems, Vacuum Sewer Design Manual, The ON-LINE System, p. 15

FIGURE 30

The Vacuum Piping Network

The collected sewage from the various interface units is transported through a piping network, kept permanently under vacuum, towards a central collecting station.



Vacuum sewage transport is essentially a plug transport. The sewage in the form of a long plug or slug is propelled through the piping. Gravity, however, tends to break down the plug and it has to be reformed at certain low points, called 'transport pockets' - installed periodically.

The pipe runs with a slight downslope towards the transport pocket, and a small lift is taken at that point to compensate for this downslope so that the pipe profile fundamentally remains horizontal under flat terrain conditions. Uphill transport is accomplished by increasing the lift to allow for the elevation of the ground contour, as well as the downslope to the pocket.

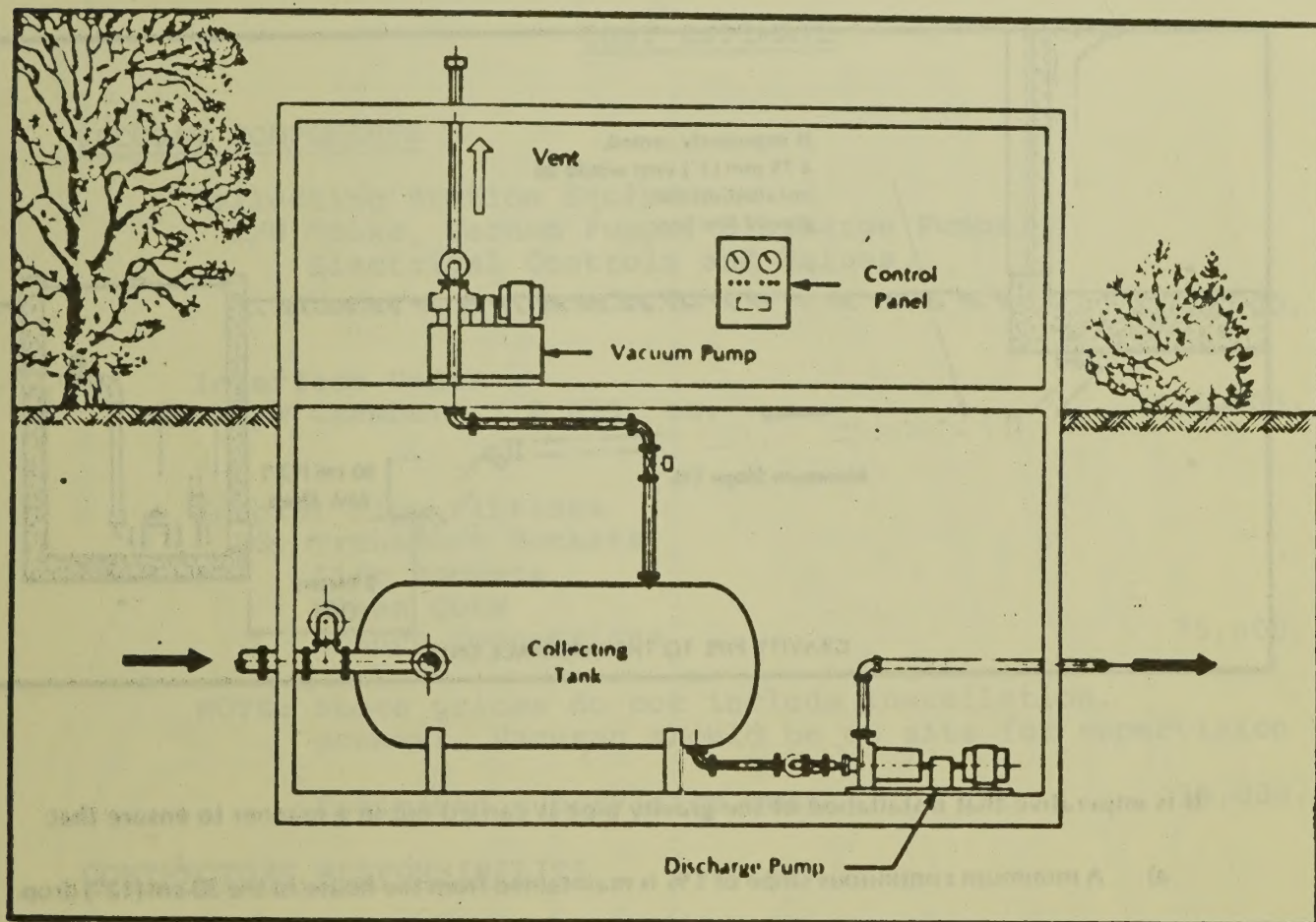
At the transport pocket, an inspection pipe is normally installed. The inspection pipe allows for detection of potential leaks, functions as a major isolation point, and can be used as a cleanout should the need occur.

Source: Vacusan Municipal Systems, Vacuum Sewer Design Manual, The ON-LINE System, p. 16.

FIGURE 31

The Collecting Station

The sewage from the piping network is collected at a central collecting station, which may serve an area of up to five miles in diameter.



The collecting station houses vacuum pump(s) to maintain vacuum, collecting tank(s) to even out peak flow, collect and store sewage, and discharge pump(s) to transfer sewage to a treatment plant, gravity sewer, or force main.

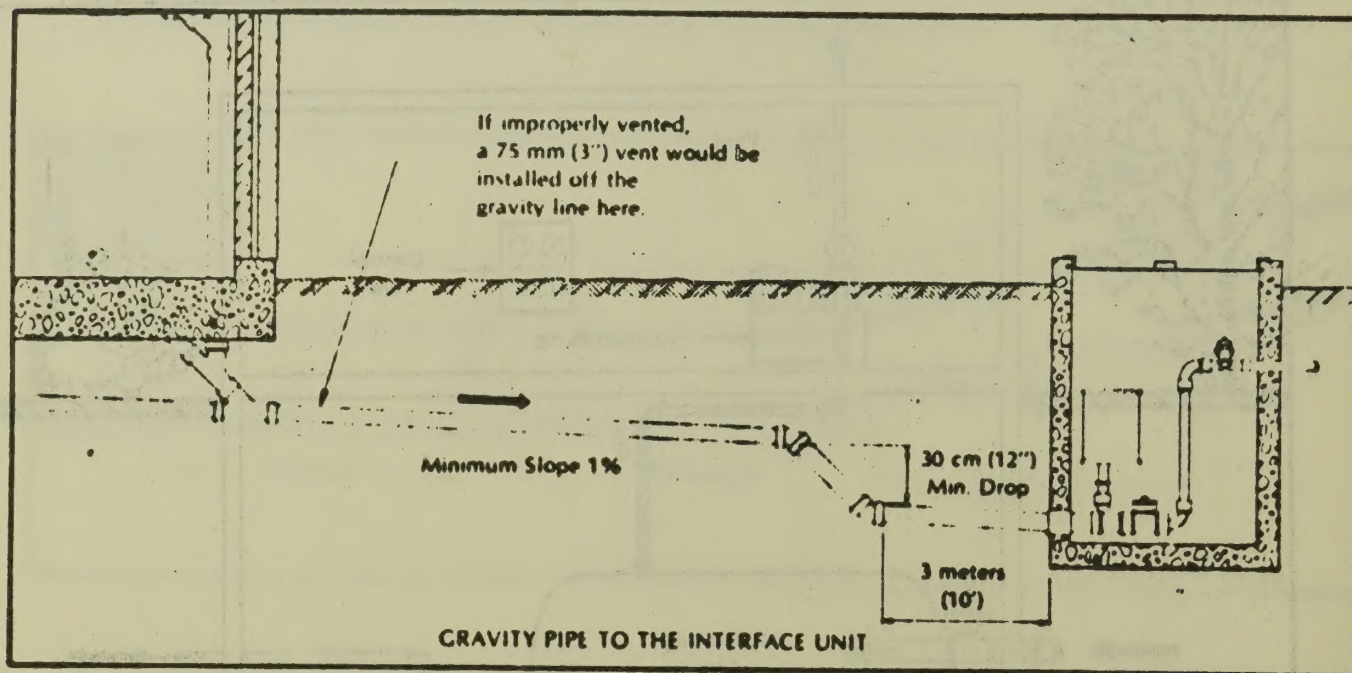
The system is automatically operated by a simple control panel. The control panel also provides operation of the automatic standby equipment.

Source: Vacusan Municipal Systems, Vacuum Sewer Design Manual, The ON-LINE System, p. 17.

FIGURE 32

Installation Of Gravity
Pipe: Standard Type Interface Unit

The gravity pipe connects the individual property to the interface unit. It provides the correct sewage volume to be interfaced and provides the static pressure signal to activate the interface unit.



It is imperative that installation of the gravity pipe is carried out in a manner to ensure that:

- a) A minimum continuous slope of 1% is maintained from the house to the 30 cm (12") drop.
- b) No low spots or pockets in any configuration allow sewage to build up or pool before the drop
- c) The drop will be a minimum of 30 cm (12") from the bottom of the gravity lateral to the top of the 100 mm (4") inlet on the chamber. i.e. 40 cm (16") centre to centre.
- d) The distance between the drop and the wall of the chamber is 3.0 meters $\pm$.3 meters (10' $\pm$ 1')
- e) The existing vent has a minimum clearance throughout of 75 mm (3"). If, after inspection, a minimum clearance is not available throughout, a 75 mm (3") vent must be installed between the house and interface unit.

FIGURE 33

Cost Estimate

500 HOME SUBDIVISIONCOST ESTIMATEVACUSAN COMPONENTS

Collecting Station Equipment C/W Tanks, Vacuum Pumps, Discharge Pumps, Electrical Controls and Valves.	\$200,000.
Interface Units C/W Chamber @ 850. ea.	425,000.
Special Pipe Fittings EG. Transport Pockets Lift Pockets Clean Outs Branch Connections	75,000.
NOTE: Above prices do not include installation. However, Vacusan should be on site for supervision	
Estimated supervision cost	35,000.

CONTRACTORS RESPONSIBILITY

Piping: PVC Schedule 40 upto 4" dia.
PVC Schedule 80 over 4" dia.

OR

Polyethylene pipe series 100

NOTE: Polyethylene is good for shallow bury
trenches with heat trace or frost board.

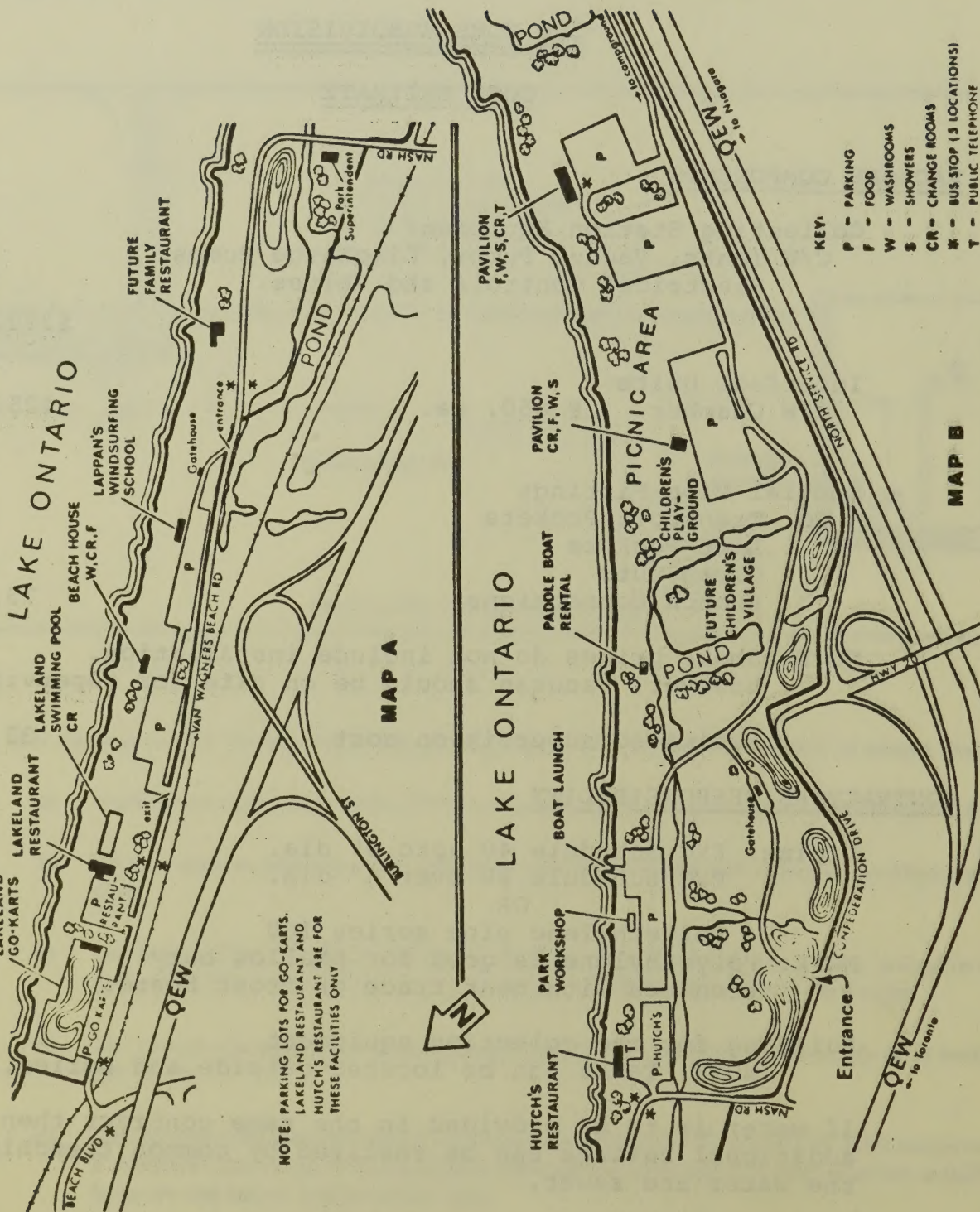
Building for the collection equipment

NOTE: Tanks can be located outside and buried.

If water is to be provided in the same contract then an
additional savings can be realized by common trenching
the water and sewer.

FIGURE 34

Recreational Facilities At Confederation Park



Appendix A

Inversions

There are three basic types of inversions:

Radiation Inversion: Such an inversion results when the air closer to the ground cools off faster than aloft during clear nights. The average height is about 100 meters. The inversion will usually last all night but during the morning when the sun warms up the ground it gradually fades from the ground up. High pollution levels can continue if a cloud develops before sunrise and inhibits the warmth of the sun.

Advection Inversion: It occurs when air cooled by a lake or ocean is blown over land and takes the place of warm air that is rising. This type of inversion can reach 100 meters therefore industries situated near a lakeshore should have stacks at least 150 meters high in order to emit pollutants above the inversion layer.

Subsidence Inversion: They are caused by the slow descent of air from higher elevations in the centre of high pressure systems. They can be quite serious because they are associated with calm or light conditions accompanying high pressure systems and because these systems tend to be stationary for long periods of time. For example in Hamilton the Air Pollution Index exceeded 31 for 91 hours in March 1979 when the City experienced a subsidence inversion.

Source: Hamilton Environment, Hamilton Air Pollution Papers: Hamilton Air Quality, 1980.

Appendix B

Major Air Pollutants

Although we would tend to think that air can be found clean in nature this is not the case. Many natural occurrences emit by-products that are pollutants. Man-made activities contribute a great deal to this naturally polluted air.

There are two basic facts which account for the accumulation of pollution in our atmosphere. Firstly, there is very little dispersion of air above 10,000 to 12,000 feet above ground level and secondly, pollutants do not rise above 2,000 feet. (1) There exists other barriers many of which are man-made, that effect the dispersion and dilution of air pollutants. So it isn't surprising that air quality in most industrial cities is relatively poor. In addition, other variables such as topography, geography and meteorology affect the air quality in an area.

Basically man-made pollutants can be classified in five categories: carbon monoxide, nitrogen oxides, hydrocarbons and photochemical oxidants, sulphur oxides, and particulates.

Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless and tasteless gas. It can be produced naturally in activities such as volcanic eruptions, natural gas emissions, electrical discharge during storms, seed germination and seedling growth. (2) But nature's contribution of CO to the atmosphere is relatively small compared to that made by man. In the U.S., the man-made emission of CO is over 100 million tons every year. (3)

Man-made CO results from the incomplete burning of fuels containing carbon and is a by-product in some industrial processes. (4) The major contributor comes from gasoline combustion in motor vehicles. CO levels range between 3 ppm in suburban areas and 15 ppm near heavy traffic. The highest concentrations can be found inside cars during heavy traffic where the level can be up to 100 - 150 ppm.

Nitrogen Oxides

Of the various nitrogen oxides (NO_x) that exists, there are two that are involved in air pollution in our urban atmosphere: nitric oxide (NO) a colourless, odourless gas; nitrogen dioxide (NO₂) a reddish-brown gas, having a pungent odour. (5) Natural bacterial action produces NO which makes up the greater proportion of NO_x. Whereas natural sources produce NO_x evenly around the earth, man-made emissions produce large quantities in concentrated areas. NO_x are produced in high temperature combustion sources. It is the heat of the

combustion which facilitates the combination of oxygen and nitrogen which occur naturally in air.

Sulphur Oxides

Sulphur oxides are emitted through combustion of any material containing sulphur. They can change from one form to another in the air, but basically two types of sulphur oxides are produced: sulphur dioxide (SO_2) a colourless gas, having pungent odor; sulphur trioxide (SO_3) a very reactive gas. Since SO_3 is extremely reactive it combines very rapidly with water vapor, forms sulphuric acid and therefore sulphuric acid is found in the atmosphere rather than SO_3 . (6) SO_2 in the atmosphere can react with oxygen, ammonia and water vapor to form sulphates and sulphuric acid mist. (7) Typical urban atmosphere contains mostly SO_2 gas, acid mist and sulphates. The range of concentration of sulphur oxides in the air are usually between 1 to 1 ppm. Concentrations also vary seasonably with greater values found in winter because of emissions from space heating. (8)

Hydrocarbons and Photochemical Oxidants

Hydrocarbons are substances that are composed of carbon and hydrogen. In air pollution, hydrocarbons referred to are the ones that are gaseous at normal ambient temperatures. The harmful effect of hydrocarbons stem from their involvement in the production of photochemical oxidants. The chemical process in which these substances are formed are rather complex and it suffices to state that the two most harmful oxidant produced are: ozone (O_3) and peroxyacetylnitrate, simplest compound in the group of peroxyacetylnitrates (PAN). Hydrocarbon reactions are directly responsible for the concentration of ozone in the air. The accumulation of ozone is one of the main features of photochemical smog. (9)

Particulates

Particulates include a wide variety of substances that are not gases. They exhibit a variety of shapes, sizes, and most importantly chemical composition. Particulates are basically categorized in relation to their size. This is a most important characteristic since it determines how far a particle will be carried and what effect it will have. The lifetime of a particulate refers to the amount of time it takes for it to settle and this can range from a few seconds to several months. Another characteristic of particulates is their ability for sorbtion; a molecule can hit a particle and instead of bouncing off, it will stick to it. The surface area is an important factor in how much a particle can sorb.

There is a variety of sources that emit quite an impressive amount of particulates each year. D.A. Lynn reports that the level of suspended particulates in an urban area averages about 100 ug/m^3 whereas in a city the level may be up to $150 - 200 \text{ ug/m}^3$. (10) Particulates act synergistically with sulphur oxides in their effect on human health. (11)

Notes

1 H. Stephen Stoker and Spencer L. Seager, Environmental Chemistry: Air and Water Pollution (Glenview, Ill.: Scott, Foresman and Co., 1972), p. 4.

2 Stoker and Seager, Environmental Chemistry, p. 10.

3 Stoker and Seager, Environmental Chemistry, p. 10.

4 Environment Canada, Canada's Air Pollution Control Program.

5 Stoker and Seager, Environmental Chemistry, p. 25

6 Stoker and Seager, Environmental Chemistry, p. 52.

7 David A. Lynn, Air Pollution- Threat and Response, (Addison-Wesley Publishing Co., 1976), p. 50.

8 Lynn, Air Pollution, p. 51

9 Lynn, Air Pollution, p. 59

10 Lynn, Air Pollution, p. 47

11 Lynn, Air Pollution, p. 42.

Appendix C

Health Effects of Air Pollutants

Carbon Monoxide

Carbon monoxide is dangerous when inhaled because it decreases the oxygen carrying capacity of the blood. It has 210 times the affinity for hemoglobin than oxygen does and therefore displaces it and forms carboxyhemoglobin. (1) Oxygen deficiency in the blood and circulatory system termed anoxia, affect body organs and demonstrates itself through headaches, irritability, dizziness and general fatigue. (2) Not only does the amount of carbon monoxide in the air affect the amount of CO in the blood, but also how active a person is.

Long term effects have been studied and the results are unclear. Some studies on traffic policemen and tunnel workers for example, found evidence of effects such as asthma, bronchitis, and reduced respiratory functions while others have failed to reach such conclusions. (3) This may be due to the fact that automobile exhaust contains other pollutants. Ill health due to prolonged exposure has yet to be clearly demonstrated. (4)

Short term exposures to high concentrations of CO may aggravate the conditions of people suffering from impaired heart or respiratory functions. (5) Short term effects of CO are reversible. After short exposure to a high concentration of CO the level of carboxyhemoglobin drops to normal in a matter of hours. (6) People who smoke cigarettes expose themselves to high levels of carbon monoxide and may of them exhibit carboxyhemoglobin levels far above those that some studies link with adverse effects. (7)

Sulphur Dioxide and Other Sulphur Compounds

In reported episodes of bad fog causing substantial sickness and even mortality, the concentration of SO₂ was very high. (8) (10-40 ppm in Meuse Valley, Belgium, 1930; greater than 1 ppm in Donora, Pennsylvania, 1948; greater than 1 ppm in London, 1952 and 1962) But in the air SO₂ can be converted to sulphuric acid and to its salts, and sulphuric acid mists were indeed present in these fogs. Concentrations of SO₂ in large industrial areas in the U.S. have been found to cause irritation in the respiratory tract and increase the incidence of respiratory disease. (9) There is disagreement on the duration of effects caused by high concentrations of SO₂ in combination with other pollutants.

Hydrogen sulphide is abundantly found in the air and is a by-product of decaying vegetation. Its life in the atmosphere is about one day and by itself it is harmless but it can react to form sulphates and SO₂ which are harmful. (10)

Nitrogen Oxides

Nitrogen oxides directly affect health; they can also react with other pollutants such as hydrocarbons to produce photochemical oxidants which are irritating. N_2O is the most common form and is produced naturally. What makes it dangerous is the fact that it contributes to the formation of other pollutants. On the other hand, nitrogen oxides that are produced through man-made emissions of which NO_2 is the most predominant, are harmful when found in high enough concentrations and also contribute to the formation of other pollutants. (11)

Nitrogen oxide has a great affinity for hemoglobin so its effects are similar to those of carbon monoxide. It isn't found in sufficient concentration to be of major concern and does not have any other effects apart from that mentioned. Nitrogen dioxide does have harmful effects on health; it can irritate respiratory tissues and cause chest pains, pulmonary edema, and even death. These effects are results of exposure to very high concentrations of NO_2 that is many times the ambient air concentration.

Smokers are exposed to higher concentrations of nitrogen oxides than non-smokers and studies point out that this may be a contributing factor in emphysema. Studies on ambient air concentrations have only led to limited and equivocal evidence of harmful effects on health. (12) There are doubts that concentrations of NO_2 found in congested urban centres are high enough to produce harmful effects and the major concern still lies with NO_x 's contribution to the formation of other pollutants. High flying aircraft produce nitrogen oxides which deplete ozone in the upper atmosphere; the result is that the shielding effect of ozone on ultraviolet radiation is now lessened and the incidence of skin cancer is on the rise. (13)

Hydrocarbons

The effects of hydrocarbons on health are direct and indirect. Methane is the most prevalent and is harmless but when it breaks down, it produces carbon monoxide in large amounts. Other hydrocarbons, unless aromatic, are harmless. Aromatic hydrocarbons are carcinogenic. (14) Hydrocarbons are very dangerous when in combination with nitrogen oxides and sunlight because they form highly reactive oxidants that irritate the eyes and respiratory tract.

Oxidants

As can be deduced from the previous sections, most of the oxidants are a product of chemical reactions of man-made emissions in the atmosphere. Oxidants are irritating and possibly harmful to health but they are highly reactive and short lived. (15) The amount of oxidants present in the atmosphere depends on how fast these pollutants are produced and these chemical reactions in turn depend on various meteorological factors. (16) Photochemical smog contains peroxyacyl nitrates and ozone in addition to other oxidants. Peroxyacyl nitrates irritate the eyes but have not proven to be a health hazard. Ozone is

toxic but it is questionable whether effects such as bronchitis, emphysema, dyspnea and pulmonary edema result from the highest ambient air concentrations of this pollutant. (17) Animal studies have suggested that the body might be able to build up a tolerance to ozone after prolonged exposure. (18)

Particulates

Due to the fact that particulates enter the body via the respiratory tract, their effects mainly involve this system. The size of the particle determines how far this pollutant will penetrate the respiratory system. The chemical properties of pollutants also determine the effect on the system. Although the body has various built-in defenses against particulates some do enter the lungs; once in the lungs, particulates that remain can exert toxic effects in the following manner: (19)

1. The particles may be intrinsically toxic because of chemical or physical characteristics;
2. The particles may be inert themselves but once in the respiratory tract they may interfere with the removal of other more harmful material;
3. The particles may carry adsorbed or absorbed irritating gas molecules and thus enable such molecules to reach and remain in sensitive areas of the lungs.

(see the following figures for summary)

Notes

- 1 Environment Canada, Air Pollution in the Urban Environment, p. 8.
- 2 Environment Canada, Pollution in the Environment, p. 8
- 3 Charles T. Stewart, Air Pollution, Human Health and Public Policy, (Lexington Books, 1979), p. 20.
- 4 Ontario Ministry of the Environment, Air Pollution and Human Health, p. 14.
- 5 Stewart, Air Pollution, p. 20.
- 6 Stewart, Air Pollution, p. 20.
- 7 Stewart, Air Pollution, p. 20.
- 8 Stewart, Air Pollution, p. 20.
- 9 Stewart, Air Pollution, p. 21.
- 10 Stewart, Air Pollution, p. 22.
- 11 Stewart, Air Pollution, p. 22.
- 12 Stewart, Air Pollution, p. 23.
- 13 Stewart, Air Pollution, p. 24.
- 14 Environmental Quality, Seventh Annual Report of the Council on Environmental Quality, (Washington: U.S. Government Printing office, 1976), p. 247.
- 15 Stewart, Air Pollution, p. 24.

16 Stewart, Air Pollution, p. 24.

17 Stewart, Air Pollution, p. 25.

18 Stewart, Air Pollution, p. 25.

19 H. Stephen Stoker and Spencer L. Seager, Environmental Chemistry: Air and Water Pollution, (Glenview, Ill.: Scott, Foresman and Co., 1972), p 73.

Diseases Associated With Air Pollution

<i>Disease</i>	<i>Associated Pollutant</i>	<i>Findings</i>
Total cancer; cancer of the respiratory system; Cancer of the digestive system	Sulfur dioxide, sulfates, particulates, benzo(a)pyrene, asbestos, ambient air pollution; also numerous other agents whose incidence is localized, such as nickel, beryllium, chromium	Numerous studies find an urban-rural differential without specifying particular pollutants
Respiratory disease mortality and morbidity	Particulates, sulfur dioxide, nitrogen dioxide, smoke, auto exhaust	Some studies find no effect on normal subjects. Greatest effect is on young children. Numerous studies find an urban-rural differential, and a differential associated with length of urban residence
Bronchitis	Same as above	Related to duration of exposure
Pneumonia	Soot fall, smoke, sulfur dioxide, sulfates	--
Tuberculosis	Sulfur dioxide, particulates	Few studies
Emphysema	Ambient air pollution, nitrogen oxides	Contrast of St. Louis and Winnipeg. Numerous studies find aggravation of symptoms among emphysematics
Cardiovascular morbidity and mortality	Ambient air pollution, sulfur dioxide, sulfates, particulates	Some studies prove inconclusive, or find no significant relation. Aggravation of symptoms among sufferers of angina pectoris. Differential rates found between urban and rural residents and between metropolitan and urban residents.

Source: Charles T. Stewart, Air Pollution, Human Health and Public Policy, (Lexington Books, 1979) p. 26.

Air Pollutants and Health: A Summary

<i>Pollutant</i>	<i>Symptoms</i>	<i>Consequences</i>	<i>Comments</i>
Carbon monoxide	Reduced visual acuity and sensory discrimination	Traffic accidents	Evidence not conclusive; effects short-term, reversible
	Reduced respiratory function	Asthma, bronchitis, aggravation of angina, arteriosclerotic disease	Increased tolerance with prolonged exposure. Evidence clear only for concentrations far in excess of EPA standards. Suspected long-term effects
Sulfur dioxide, sulfates	Irritation of respiratory system	Excess mortality	In combination with particulates and humidity, in concentrations above EPA standards
	Reduced respiratory function	Emphysema, bronchitis, other respiratory diseases	Some evidence of development of resistance with prolonged exposure
Nitrogen dioxide, nitrates	Irritation of respiratory tract	Bronchitis, other respiratory illnesses	Effects on health questionable at EPA standards
	Reduced respiratory function; reduced resistance to infection	Excess mortality; hypertensive heart disease suspected	Effects may be reversible; development of tolerance under prolonged exposure suspected, in single report
Hydrocarbons	A few are irritating to eyes, respiratory tract	Cancer	Most hydrocarbons are not themselves harmful, except aromatics and olefins; hydrocarbons are oxidant precursors (for example, benzo(a)pyrene)
Oxidants	Irritation of eyes, respiratory tract	Bronchitis, asthma, emphysema, difficulty in breathing	Effects on mortality questionable; lasting tolerance built up by prolonged exposure
Particulates	Irritation of eyes, respiratory tract	Excess infant mortality; respiratory disease; some types of cancer	Particulates include some sulfates, aromatic hydrocarbons, nitrates. Some, such as asbestos and nickel, cause cancer

Source: Charles T. Stewart, Air Pollution, Human Health and Public Policy, p. 31.

Appendix D

How Soil Treats Domestic Sewage

In order to provide further treatment of effluent leaving a septic tank it is necessary to have a certain depth of moderately absorbent soil between the bottom of the absorption trenches and the water table. It is generally held that there must be at least .90 m. (3 ft.) of unsaturated soil having a coefficient of percolation (1) no faster than .04 min./cm. (.10 min./in.) and no slower than 24 min./cm. (60 min./in.) between the bottom of the absorption trenches and the water table for effluent to be treated properly. (2)

Although the above standards are generally accepted in most jurisdictions, Ontario standards differ to a certain extent. According to Ontario regulations, there must be at least .50 m. of unsaturated soil having a percolation rate no faster than 1 min./cm. (2.5 min./in.) and no slower than 20 min./cm. (50 min./in.) for soil absorption systems to be accepted by the Province. (3)

It is absolutely necessary to have the required amount of unsaturated soil for the proper treatment of wastewater. Beneath a properly operating drain field, soil will be unsaturated even though there may be effluent ponded within the trenches. Unsaturated flow is established by a biological layer that develops at the interface of the bottom of the trenches and soil. This layer is composed of microorganisms both from the soil and the tank effluent. These microbes attach themselves to the soil particles and to each other by secreting polysaccharides, muco-proteins and other waste products. This network traps some of the suspended solids and forms a black jelly-like layer about 2-5 cm. (1-2 in.) thick along the bottom and sidewalls of the trenches. Although the microbes within the layer participate in the treatment process by feeding on suspended and dissolved solids, the primary function of the layer is the establishment of unsaturated flow in the soil below. Movement of the liquid is slow, allowing contact time between the effluent, soil particles and soil organisms. Bacteria, already weakened by the drop in temperature and moisture, are trapped between the soil particles and become easy prey for soil microorganisms. By the time the effluent reaches the required depth below the bottom of the trenches, all biochemical oxygen demand, suspended solids, fecal bacteria and viruses have been removed. Certain dissolved substances remain necessitating setbacks from water supplies and surface waters to allow for dilution in the case of nitrates, and adsorption for phosphates. (4) In Ontario, absorption fields must be set back at least 15 m. (50 ft.) from wells and water bodies. (5)

Notes

- 1 Defined as the velocity with which water flow occurs through a cross-sectional area of soil equal to that occupied by both pores and solids. C.A. Hogentogler, ed., Engineering Properties of Soil, (N.Y.C.: McGraw Hill Inc., 1937), pp. 116-117. In general, silt soils have a faster percolation rate than clay soils and sandy soils have a faster percolation rate than silt soils. Sandy loam soils that have a percolation coefficient of 6 min./cm. (15 min./in.) are most suitable for absorption field operation. Environment Canada, Small Wastewater Systems, p. 44.
- 2 M.J. Hansel, R.E. Machmeir, "On-Site Wastewater Treatment On Problem Soils ", Water Pollution Control Federation Journal, Vol 52, No. 3, p. 548.
- 3 Province of Ontario, Regulation 374/81, sec's. 10(3), 10(5).
- 4 Hansel, Machmeir, On-Site Wastewater Treatment, pp. 549-550.
- 5 Ontario Ministry of the Environment, Facts About Septic Tank Systems, p. 2.

Appendix E

Letter From Regional Health Unit

HAMILTON-WENTWORTH REGIONAL HEALTH UNIT

A.I. CUNNINGHAM, M.D., D.T.M.H., D.P.M.
MEDICAL OFFICER OF HEALTH

P.O. BOX 897, HAMILTON, ONT.
CANADA L8N 3P6
TEL. 528-1441

March 3, 1982.

Michael Gagnon,
Vice President,
Hamilton Beach Preservation Committee,
668 Beach Boulevard,
Hamilton, Ontario.

Attention: Robert Mendelson,
Project Manager

Dear Sir:

A study has been made of our files with reference to your questionnaire, which we received February 16th, 1982, with the following report.

The area of concern within the boundaries of the Regional Municipality of Hamilton-Wentworth begins at a southern point at Windermere Avenue, and runs northerly to the canal. The east side of the beach strip being on Lake Ontario, has a higher elevation than the west side, which is on Hamilton Bay. Most of the systems on the east side are, as far as we know, inground septic tank beds built in accordance with the regulations at the time they were installed. Those on the west side of the strip, due to the high water table, are the cesspool type, or better known as dry wells. The water-carried household waste may or may not pass through a septic tank before it flows into these underground pits. This cesspool is lined with bricks, blocks, stone or even railway ties, all set loose enough to allow the effluent to seep through and dissipate into the ground.

The sandy soil, having a high absorbency rate, is capable of taking huge volumes of water. As the sludge keeps accumulating from these pits, the pores on the side and in the surrounding soil may become clogged in the course of the years, forcing the effluent up to the surface. Cleaning out these pits and removal of the sludge-saturated earth around them will usually eliminate the sewage ponding. When these cesspool pits become worn out and can no longer efficiently operate, the owner is advised to install a holding tank, which of course must be regularly pumped out by a licensed sewage hauler.

We have had complaints about cellar and crawl spaces flooded with sewage polluted ground water. The only thing that can be done to correct this is to have the cesspool pumped out.

/.....2

- 2 -

The potential public health problems emerging in this area would include the hazard of communicable disease, transmission by flies or by direct contact where the sewage ponding or flooding occurs.

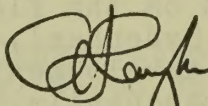
In the period of 1978 through the end of 1981, the yearly average of reported cases of sewage disposal system defects in the area was four, and mainly involves premises where raw effluent surfaced in the yard, and was exposed long enough to cause neighbours or tenants to complain to this Health Unit about the stench.

There is a possibility that some owner-occupied dwellings where there has been an occurrence of sewage seepage into the cellar or crawl space would not be reported. Thus the actual number of occurrences was probably higher. So far this year, we have not received any complaints pertaining to defective septic systems in this area.

Hoping this may be of some assistance to your development project,

I remain,

Yours very truly,



A. I. Cunningham, M.D., D.P.H.,
D.T.M.H. (London),
Medical Officer of Health.

AIC:AAT:cs

Appendix F

Floodplain Regulations In The Hamilton-Wentworth Region

According to the Ontario Conservation Authorities Act and Ontario Regulation 118/70, Authorities are empowered to make regulations prohibiting or regulating the construction of buildings or the placing of fill in any area under their jurisdictions that is susceptible to flooding during a regional storm. A regional storm produces a specified amount of rainfall in a local drainage area during a 48-hour period. It is a local event designed to show the probability of flooding along watercourses. In the Hamilton Region, a storm affecting a drainage area of 10 square miles or less is classified a regional storm if it produces 11.21 inches of rainfall in a 48-hour period. Rainfall levels are adjusted downward for larger drainage areas. (1)

In most of the Region, development is not allowed on watercourse floodplains as defined by the regional storm. One notable exception is found in the Town of Dundas. Because Dundas has been built on the floodplains of three creeks (Spencer, Annst. and Sydenham), its survival and future growth depend on continuing development and redevelopment along the floodplains. (2) Subsequently, sections of the three floodplains have been designated special policy areas for the purpose of redevelopment and infill development.

In these areas, floodplains are divided into two zones, the first being the floodway, within which no buildings or fill can be placed, and the floodfringe (3), where buildings are permitted as long as they are adequately floodproofed. (4)

Although the Region Conservation Authority has jurisdiction over the lakeshore, officials are reluctant to develop flood and fill regulations at the present time since the art of predicting lakeshore flooding is currently undeveloped. (5)

Notes

1

Hamilton Region Conservation Authority, Fill, Construction and Alterations to Waterways, June 1979, pp. 5-7.

2

Hamilton Region Conservation Authority, Review of Floodplain Regulations For Town of Dundas, May 1978, p. 8.

3

The floodway is defined as the floodplain resulting from the 100-year storm while the floodfringe is defined as the difference between the regional and 100-year floodplain. Hamilton Region Conservation Authority, Review of Floodplain Regulations, pp. 8-9.

4

Commercial structures can be raised above the floodline by using either fill or structural floodproofing methods. Residential structures can only be raised above the floodline with fill. Hamilton Region Conservation Authority, Review of Floodplain Regulations, p. 10.

5

Interview with Ken Dakin, Conservation Planner, Hamilton Region Conservation Authority, March 28, 1982.

Appendix G

Urban Protected Residential Zoning

Requirements as to use

9. (1) Subject to the provisions of sections 3, 18 and 19, in a C district no building or structure shall be erected, altered, extended, or enlarged, nor shall any building or structure or part thereof be used, nor shall any land be used, for other than one or more of the following uses, namely: - (8158/57)

RESIDENTIAL USES

- (i) A single-family dwelling, together with the accommodation of lodgers to the number of not more than three; (81-27)
- (ii) A converted dwelling, containing two Class A dwelling units only, and not used for accommodation for any lodger; (6902/52) (81-27)
- (iia) A foster home; (10837/65) (81-27)
- (iib) A residential care facility for the accommodation of not more than 6 residents. (81-27)

INSTITUTIONAL USES

- (iii) A day nursery for the accommodation of the lesser of twenty-five children or of one child for every 5.5 square metres (59.20 square feet) of area of the rear yard with the proviso that the outside play area shall be restricted to the rear yard; but neither the restriction as to the number of children nor the restriction as to the location of the outside play area shall apply where such Day Nursery is operated in a church hall, church, school, community centre, or other such public building; (10743/65) (79-288) (80-049)

PUBLIC USES

- (iv) A school or seminary of learning except a commercial school or sanitarium school, and not including a dormitory; (66-273)

PUBLIC USES (CONT'D.)

9. (1) (iva) A college or university in the case of the blocks bounded by Main Street West, Cootes Drive, King Street West and Forsythe Avenue and in the case of the lands owned by McMaster University as of October 11, 1966 lying west of Forsythe Avenue. (66-273)
- (v) A library, art gallery, museum, observatory, community centre or other such cultural, recreational or community building or structure, except one carried on as a business, or of a kind that is customarily carried on as a business. Provided that a Community Centre, permitted under this paragraph shall be one that is operated for the benefit of all residents of a given neighbourhood, and where all such residents are afforded opportunity for recreational activities, and where individuals may be permitted to combine into groups to do their own canning and for any other self-help programs with respect to home economy or the household arts; and (6692/51)
- (vi) A bowling green, tennis court, playground, playfield, play lot or other such recreational use except one carried on as a business, or of a kind that is customarily carried on as a business,
- Provided, however, that any building permitted in connection with any such tennis court, bowling green or other recreational use shall be limited to such locker-rooms, dressing rooms, shower baths, and other such accessory uses necessary for their operation; (7085/53)

MISCELLANEOUS OR INCIDENTAL USES

- (vii) A private garage or private stable;
- (viii) Parking spaces to such a number as is reasonably necessary for a permitted use to which the same is appurtenant, provided that the same are hard-surfaced and abut upon a hard-surfaced driveway giving ready access to a street or alley, and that same are used only as appurtenant to such permitted use, (6902/52)

And provided further that the foregoing shall not be construed so as to permit the expansion for such purpose of a non-conforming use; (6902/52)

MISCELLANEOUS OR INCIDENTAL USES (CONT'D.)

9. (1) (ix) A storage garage of such capacity as is reasonably necessary for a permitted use to which the same is appurtenant, provided that same is used only as appurtenant to such permitted use, (6902/52)

And provided further that the foregoing shall not be construed so as to permit the expansion for such purpose, of a non-conforming use; (6902/52)

HEIGHT REQUIREMENTS

- (2) In a C district, no building shall exceed two and a half storeys, and no structure shall exceed 11.0 metres (36.09 feet), in height. (9141/60) (79-288) (80-049)

AREA REQUIREMENTS

- (3) The following yards shall be provided within the district, and maintained, as appurtenant to every building or structure in a C district: (8927/60)
- (i) a front yard of a depth of at least 6.0 metres (19.69 feet); (79-288) (80-049)
 - (ii) a side yard along each side lot line, of a width of at least 1.2 metres (3.94 feet); (6902/52) (79-288) (80-049)
 - (iii) a rear yard of a depth of at least 7.5 metres (24.61 feet). (79-288) (80-049)

INTENSITY OF USE

- (4) Every lot or tract of land in a C district shall have a width of at least 12.0 metres (39.37 feet) and an area of at least 360.0 square metres (3,875.01 square feet) within the district. (8927/60) (6908/52) (79-288) (80-049)

DISTANCE REQUIREMENTS

- (5) Except as provided in subsection 6, every residential care facility shall be situate on a lot having a minimum radial separation distance of 180.0 metres from the lot line to the lot line of any other lot occupied or as may be occupied by a residential care facility or a short-term care facility. (81-27)

DISTANCE REQUIREMENTS (CONT'D)

9. (6) Where the radial separation distance from the lot line of an existing residential care facility is less than 180.0 metres to the lot line of any other lot occupied by a residential care facility or short-term care facility, the existing residential care facility may be expanded or redeveloped to accommodate not more than the permitted number of residents. (81-27)

Source: City of Hamilton, Zoning By-Law, pp. 9-1 to 9-4.

Appendix H

How Sanitary Sewers Are Financed In Hamilton-Wentworth Region

Sanitary sewer projects are authorized and initiated on a priority basis in Hamilton-Wentworth Region. Projects which protect the safety, health and environmental well-being of the Community are given top priority, followed by projects which facilitate industrial development and projects required for existing and committed residential development. (1)

The financing of sanitary sewer systems is broken down into four categories: major capital projects, i.e., forcemains; minor capital projects, i.e., pumping stations; local improvements, i.e., connection to lot lines; and individual property improvements, i.e., connection to the house from the lot line. (2)

Costs for the first three categories are shared by the Region and property owners who benefit from the improvements. In the case of both major and minor capital projects, the owners' portion of the cost is specially assessed to properties themselves on a metred basis. In Hamilton-Wentworth Region this assessment amounts to \$102 per metre of frontage abutting on the sewer improvement. Owners have the choice of paying their share of the sewer improvement in one lump sum payment or having this amount added on to their property tax bills over a period of 15 years. The remaining portion of the cost is paid by the Region out of its operating budget. (3) Homeowners must hire a general contractor at their own expense to hook the sewer up to their houses from lot lines. Homeowners pay for the use of sewer facilities through a sanitary sewer surcharge, amounting to 115% of their water bill and paid at three-month intervals. (4)

The overall capital costs of sewer projects to the Region and property owners can be significantly reduced if government subsidies are applied for and received. Two major sources of government funding for local capital improvement projects in the Province of Ontario are the Ontario Ministry of Housing, Community Renewal Branch and the Ontario Ministry of the Environment. The former administers the Ontario Neighbourhood Improvement (ONIP) Program and can fund 50% of the capital costs of new sewer mains and laterals (5) while the latter offers grants to pay up to 15% of the capital costs of new sewer mains. (6)

Notes

1

The Regional Municipality of Hamilton-Wentworth, 1982-1986 Capital Budget, Financial Report, pp. A1-A3.

2

Interview with Gary Scandlan, Supervisor of Capital Programmes, Regional Municipality of Hamilton-Wentworth, June 22, 1982.

3

The Region has the authority to issue debentures to cover the owner's portion of the capital costs if owners elect to pay their share over the extended period of time. Due to current high interest rates however, the Region has adopted a policy of reducing debt financing and doing as many capital projects as possible out of current funds. Debt charges have been limited to 45% of the Sanitary Sewer revenues for 1982 and subsequent years. Hamilton-Wentworth, 1982-86 Capital Budget, Schedule 1.

4

Interview with Cindy Clarke, Supervisor of Local Improvements and Development Control, Finance Department, Regional Municipality of Hamilton-Wentworth, June 22, 1982.

5

To qualify for ONIP funding, targeted areas must: be classified as Redevelopment Areas through by-laws; have populations with average household incomes below either the average provincial household income or the average household income of the municipality; be at least 50% residential; and have at least 25% of the housing stock in need of rehabilitation. Ontario Ministry of Housing, Community Renewal Branch, Ontario Neighbourhood Improvement Program: Program Administration Outline, August 1981, p. 6.

6

Ontario Ministry of the Environment, Facts About A New Ontario Plan To Broaden Assistance To Municipal Water And Sewer Projects, 1981.

Appendix I

Existing And Proposed Parks And
Waterfront Access Locations In Halton-Wentworth

Street-End Parks

Oakville	1 Ninth Line 0.9	9 East St. 0.48
	2 Second St. 0.20	10 Nelson St. 0.49
	3 First St. 0.21	11 West River St. 0.52
	4 Brookfield Rd. 0.33	12 Mississauga St. 0.53
	5 Holyrood Ave. 0.34(E)	13 Timber St. 0.55
	6 Westdale Rd. 0.38	14 West St. 0.56
	7 Belvedere Dr. 0.44	
	8 Third Line 0.46	
Burlington	1 Appleby Pl. B.10*	10 Pearl St. B.10
	2 Walkers Line B.13*	11 Elizabeth St. B.31
	3 Fruitland Ave. B.17	12 Allview Ave. B.46
	4 Lakeland Cres. B.18	13 Stillwater Cres. B.46
	5 Guelph Line B.22*	14 King Road B.47*
	6 St. Paul St. B.23*	15 Edgewater Ave. B.48
	7 Market St. B.24*	16 Dayswater Ave. B.50
	8 Green St. B.25*	17 Glenhaven Ave. B.51*
	9 Clifferest Ct. B.26 (P)	18 Powder Magazine Rd. B5
		19 Eagle Drive B50a
Hamilton	1 Gray Road H.50	

Stoney
Creek

1 Teal Ave. S.2 (E,P)	8 Glover Rd. S.16
2 Green Rd. S.3	9 McNeilly Rd. S.17
3 Millen Rd. S.7	10 Lewis Rd. S.20
4 Cherry Beach S.9	11 Winona Rd. S.24
5 Dewitt Rd. S.10	12 East St. S.25
6 Fruitland Rd. S.11	13 Creanona Blvd. S.26
7 Jones Rd. S.14	14 Fifty Rd. S.27

Creek-Mouth Parks and
Trails (13 parks,
8150 ft. of trails)

Oakville	1 Wedgewood Ck 0.11
	2 Morrison Ck. 0.14 (Ep)
	3 Brookfield Cres. 0.32
	4 Birch Hill Lane 0.36
	5 Taplow Ck. 0.37 (E,P)
	6 Fourteen Milo Ck. 0.39
	7 Sheldon Ck. 0.58

P : Private

E : Existing

Ep : Partly Existing

* : Priority location, should be established in first
phase of implementation.

	Burlington	1 Appleby Ck. B.9 2 Shoreacres Ck. B.12* 3 Tuck Ck. B.14 4 Roseland Ck. B.19 (E) 5 Rambo Ck. B.29* 6 Indian Ck. B.43
romenades (67,000 ft., 4 locations)	Oakville	Seventeen location of varying lengths. Total length 21,000 ft.
	Burlington	Eleven locationstotalling 15,000 ft.
	Hamilton	Three locationstotalling 11,900 ft.
	Stoney Creek	Three locations totalling 19,400 ft.
Community Parks (10)	Oakville	1. Gairloch Gardens 0.14 (E) 2. Oakville Harbour 0.27, 0.30 (Ep) 3. Coronation Park (E)
	Burlington	1. Shoreacres B.12 2. Spencer Smith B.33-B.34 (E) 3. LaSalle B.52 (E) 4. Brighton Beach B.60 (E,P)
	Hamilton	1. Hamilton Waterfront Park H.9-H.15
	Stoney Creek	1. Cherry Beach S.7 to S.10 2. Trillium Bay S.17 to S.21
ional Parks (5)		1. Joshua's Creek 2. Bronte Creek/Sheldon Creek 3. The Beach (including Indian Creek, Burlington Beach, Hamilton Beach, Confederation Park, Redhill Creek) 4. Cootes Paradise/Royal Botanical Gardens 5. Fifty Point Conservation Area
ial Shore Access re easements may to be arranged)		1. Aintree Terrace 0.7 2. Bergundy Dr. 0.16

Source: Acres Consulting Services Ltd., and Project Planning Associates, The Halton-Wentworth Waterfront Study, p. 174.

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